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Oxyuris Vermicularis

(THE THREADWORM).

A TREATISE ON THE PARASITE AND THE DISEASE
IN CHILDREN AND ADULTS,

TOGETHER WITH PARTICULARS OF

A RAPID, HARMLESS AND RELIABLE CURE.

By

MAURICE ERNST, LL.D. (VIENNA),

Consulting Homœopath.

Oxyuris Vermicularis.



Male.



Female.

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together with particulars of

A RAPID, HARMLESS AND RELIABLE CURE.

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FOREWORD.

WHEN I definitely took up the study of Medicine some twenty years ago, it was in the belief that I was to be initiated into the science of Healing. Like many another student, I was soon to be disillusioned; and as I pursued my studies I became more and more dismayed at the confusion which prevailed in this branch of learning, a confusion which, curiously enough, is countenanced by its professors.

The medical curriculum was then, and is still, overburdened with a mass of extraneous matter. Smatterings of Chemistry, Physics and Biology, much irrelevant Anatomy and Physiology, vague speculations in Pathology, and an elaborate *Materia Medica* of no practical value absorb all the future physician's time, while little more than passing reference is made to Therapeutics, the science of healing, which should be, beyond question, the *Alpha* and *Omega* of all medical study and effort.

Finally I resolved to follow another profession.

But during all these twenty years my interest in Therapeutics has never flagged, and as time has worn on I have come to realise more and more clearly the principles upon which all Curative Treatment must be based. These principles I have, as occasion arose, applied with almost invariable success in many seemingly hopeless cases, as hundreds of my patients testify; and having lately placed all other interests aside, I am now able to carry out a life-long ambition, by devoting myself entirely to the practice and advancement of Therapeutics—the science of healing proper.

MAURICE ERNST, LL.D. (*Vienna*).

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I. SIMPLE CURE VERSUS DRASTIC TREATMENTS.

I have written this little book on the Threadworm¹ (*Oxyuris Vermicularis*²) because I know a certain means of curing the disease familiarly spoken of as the "worms³." The chief agent in the cure is a vegetable extract, a weak solution of which, when taken internally, expels or kills all the worms along the whole course of the intestine within a few hours, without causing the sufferer any pain, inconvenience, or injury. In this last particular this tincture differs very markedly from the multitude of popular worm-cakes and worm-powders, which are mostly composed of some powerful drug, and often have a lasting deleterious effect upon the constitution of the patient, more especially if a delicate child.

¹ "The human threadworms, properly so called, refer exclusively to the species termed *Oxyuris Vermicularis*." (COBBOLD, T. S., *Worms, a series of lectures*, London, 1872, p. 80.)

² *Synonyma* :—'Ἀσκαρίς (Hippocrates, Aristotle, Galen, Oribasius, Aetius, etc.); *Ascaris* (Pierre de Albano, Coelius Aerulianus, Mercurialis, etc.); *Ascaris parvus* (Avicenna in the translation of P. de Albano); *Lumbriculus* (Aldrovande); *parvus*, *gracilis* (Serapion); *parvus et rotundus* (Lillanus); *parvus ac tenuis* (Actuarius); *curtus*, *gracilis* (Gordon); *curtus et rotundus* (Arn. de Villeneuve); *le petit et grele*, *ascaride* (Ambr. Paré); *Ascaris pollicaris*. (Linnaeus in *Fauna suecica*, No. 1269); *Ascaris vermicularis* (Linnaeus, 1767, *System. natur.* xii., 1076); *Ascaride vermiculaire* (Cuvier); *Ascaris Graecorum* (Pal-

las); *Ascaris cauda setacea* (Müller, *Hist. verm.* 1, 2, 34); *Ascaris vermicularis cauda subulata* (Goeze, 1782); *Vermis Ascaris* (Clericus); *Fusaria vermicularis* (Zeder, 1800); *Ascaride vermicolare* (Brera); *Oxyuris vermicularis* (Bremser (1819), Dujardin, von Siebold, Rudolphi, Diesing); *Oxyuris vermicularis* (R. Blanchard, 1889).

³ English :—Threadworm, maw-worm, pin-worm, seat-worm.

German :—Pfriemenschwanz, Springwurm, Afterwurm, Madenwurm, Arschmade, Aftermade, Kinderwurm, Mastdarmwurm, Darmschabe, Spitzschwanz.

French :—Ver court.

Italian :—Vermicciolo.

Spanish :—Lombricilla filiforme.

Dutch :—Barnmask.

Swedish :—Aarsmade.

Danish :—Smaa spolerme, boerneorm.

Rapidity of Action.

The method of taking the tincture is extremely simple. Two or three drops are added to a glass of cold water and drunk before meals. The effect is most striking. After the first few doses, the characteristic irritation caused by the parasites ceases, and the worms which appear in the stools are mostly dead. To make assurance doubly sure, the doses of the tincture are repeated until no more worms are passed, and the sufferer is entirely freed from the trouble. The rapidity with which the drug does its work is not the least of its merits. Indeed, if it is a child which has been attacked by worms, it often becomes rosy, bright-eyed and cheerful again within two or three days.

Reliability.

The usefulness of this tincture is not a matter of speculation. It has undergone practical test with a large number of sufferers. It has been taken with complete success by men, women, and children of all ages ; it has been quite effective in many obstinate and long-standing cases of the complaint, where orthodox treatments have previously proved unsatisfactory or useless ; indeed, it has never, to my knowledge, failed in a single instance to dislodge and destroy the parasite. I have, therefore, no hesitation in declaring it to be thoroughly reliable.

Harmlessness.

The medicine is tasteless and odourless, and is taken readily even by young children. Its administration calls for no preliminary, or accessory, measures, such as fasting, purgation or injections. It is not poisonous, even in an over-dose. It causes neither pain nor diarrhœa. Unlike most drugs given as "cures" for worms, it does not irritate the mucous lining of the alimentary canal, however sensitive the subject. It is, therefore, in no way unpleasant, and is perfectly harmless even to the youngest infant¹ ; while the medical man who

¹ The danger to infants of so-called worm-remedies was recognised as early as the 18th century : — "What adds to the misfortune of infants is that most of the remedies which are recommended for the destruction of worms, are either harsh in their nature, or violent

in their operation. How many lives have fallen a sacrifice to anthelmintick cakes, worm-killing powders, and drastic purges !" (HULME, N.. *A safe and easy remedy for the destruction of worms in the human body*, London, 1778, pp. 21, 22.)

prescribes it is able to conform to the golden rule of HIPPOCRATES—"Never risk doing harm."

The Constitutional Treatment.

To sum up, the tincture is a true specific in clearing the body of threadworms. It acts—to quote the famous motto of ASCLEPIADES—"safely, quickly, and pleasantly" (*tuto, celeriter, ac jucunde*). And when, by its means, the parasites have been expelled, the constitutional evils which accompany their presence can be dealt with, according to the individual case and its complications. In most cases a gentle course of recuperative treatment (of which I shall give an outline later on) will suffice to restore the patient's constitution¹, and I need hardly add that hygienic measures against re-infection must simultaneously receive strict attention.

Disease considered incurable by Authorities.

Such is the simple cure which I have found invariably efficacious for this complaint, the treatment of which has baffled so many eminent specialists. Indeed, threadworm disease has often been regarded as incurable by some who found no difficulty with other parasites. At the same time I do not wish, for a moment, to imply that medical men, as a body, have ever admitted that they did not know how to treat this malady. Probably no human ill has been more minutely investigated; probably none has called forth a more prodigious number of "treatments," and probably none better illustrates the perverted state of orthodox medical science and practice. Everything has been learnt about this common disease, its causes, its symptoms, its course and complications; in short, everything—except its cure.

The Study of the Disease.

The parasite has been known for thousands of years, to the laity no less than to medical men. It occurs in every country and under every climate. Being visible to the naked eye,

¹ Constitutional treatment of some kind in Threadworm disease is demanded by many authorities:—"Dans tous les cas, leur expulsion n'est définitive que si le régime ou la constitution, ou

l'état moral du malade est changé convenablement." (DUJARDIN, M. F., *Histoire naturelle des helminthes ou vers intestinaux*, Paris, 1845, p. 139.)

its discovery did not have to await the invention of the microscope. HIPPOCRATES, the Father of Medicine, mentions it as familiar in his day, and seems to have treated many cases. Innumerable authors and scientists have since written of it; and, it may be truly said, that the references to this minute animal from the clinical and zoological points of view would fill a library of respectable dimensions to overflowing.

Zoologists and the Threadworm.

Zoologists have classified, and re-classified the parasite, and its life history has been painstakingly investigated. Its anatomy has been described in detail, and its physiology has engaged the earnest attention of many eminent biologists. Its parts and organs have been measured with inconceivable care, and the measurements have been recorded to the smallest fraction of a millimetre¹. Its digestive, reproductive and other

¹ This was done by KUECHENMEISTER, some of whose figures are appended:—Mas: 2·05 mill., ad 2·5 mill., ad 3·37 mill. longus (si caudam semper curvatam tamquam linea recta extensam mensus es); in capite una cum appendicibus 0·094 mill., sine appendicibus 0·024 mill., medio in corpore 0·123 mill., in cauda 0·023 mill. latus. . . . Oesophagus sequitur brevis tubi intestinalis strictura 0·008 mill. longa, et 0·016 mill. lata. Postea sequitur ventriculus 0·115 mill. longus, et 0·065 mill. latus, cum valvularum apparatu cognito; tubus intestinalis paulo post ventriculum latitudinis 0·057 mill. est, ad anum vero usque ad 0·008 mill. . . . Penis simplex, 0·057 mill. longus, ad basin 0·008 mill., in apice vero semper ad hamuli instar recurvato, latitudinis (adultum 0·003 mill.).

Femina: 7·84 ex aliis ad 10 mill. longa; in capitis apice cum appendicibus 0·196 mill.; sine appendicibus 0·065 mill.; in medio corpore 0·49 ad 0·59; extremitas caudalis acutissima. Longitudo caudae (i.e., partis inter anum et apicem) 1·798 mill.; latitudo caudae ad anum ipsam 0·26 mill.,

inde diminuitur. Oesophagus 0·65 mill. longus, in capitis apice 0·065 mill., in parte posteriore 0·098 mill. latus. Strictura tubi intestinalis pone oesophagum uti in maribus perbrevis et 0·028 mill. lata. Ventriculus 0·172 mill. et longus et latus, interdum latitudine aliquid minor. Vagina ex Dujardini mensuris 1·8 mill., ex meis ad 1·64 mill. pone caput sita; in vivis 1·06-1·2 mill. longa et 0·11 mill. lata; cum foramine latitudinis 0·13 mill., longitudinis 0·15 mill.; uterus duplex, cujus ramus posterior 2·0 mill., cujus anterior 1·35 mill. longus; ramorum ovulis impletorum latitudo ad 0·4 mill. et ultra ovulis expulsis, 0·2 mill.; ovarium duplex, in transitu uteri in anum 0·03 mill. latum.

Ovula fere oblonga non symmetrica; ex Dujardini mensuris 0·055 mill. lata et 0·064 mill. longa, ex meis media in parte ovulorum 0·029 mill. in apicibus circiter 0·012 mill. lata et 0·05 mill. longa. . . . (KUECHENMEISTER, G. F. A., *Die in und an dem Koerper des lebenden Menschen vorkommenden Parasiten*, Leipzig, 1855, vol. i., pp. 276-8.)

functions have been exhaustively studied, and even the nervous system of the threadworm has been the subject of no little heated discussion amongst helminthologists¹.

Physicians and Threadworm Disease.

Medical men, again, on their part, have advanced an endless number of theories to account for the presence of the worm, and for the phenomena it produces. They have, with scrupulous care, noted every symptom of threadworm disease in the living, and, in modern times, laboriously searched the tissues of the dead for indications of its presence and effects. They have striven to locate the haunts of the parasite in the intestines, and enthusiastically recorded, in scientific journals, every instance of a worm found in an abnormal situation. But at this point orthodox medical science stops short, and the question of treatment seems to have been almost entirely overlooked in favour of the other branches of the subject. It was a mediæval tradition that the treatment of "worms" was not worthy of the attention of a learned physician², and, it is not to be wondered at that the treatment of this malady receives no serious consideration at the present time, when Therapeutics as a whole are so utterly neglected.

Drastic Treatment based on wrong Principles.

The underlying principle of all treatments for "worms," in antiquity, was purging. It remains the same to this day. The reasoning on which this is based seems to be logically perfect, but experience shows that, in Therapeutics, logic and dialectics are invariably at fault. The faculty has always argued: Purgatives clear out the contents of the bowels. *Item*: The seat of the parasite is in the bowels. *Ergo*: The more drastic the purgative, the more complete the expulsion

¹ It is of interest to note that KUECHENMEISTER had suffered from threadworms for years when he published his celebrated work on parasites. He admitted that, in spite of his intricate knowledge of *Oxyuris*, he was unable to cure himself:—"Ich selbst leide noch jetzt in meinem fünfundreissigsten Jahre daran." (KUECHENMEISTER, G. F. A., *ibid.*, vol. i., p. 287.)

² "Les vers du canal digestif ont été suivant ces deux opinions, tantôt recherchés avec soin, combattus avec acharnement; tantôt considérés comme peu dignes de l'attention du medecin, et ne reclamant aucun moyen particulier." (FUCHET, B., *Recherches sur les causes et les effets des vers qui ont leur siège dans l'estomac et le canal intestinal*, Paris, 1819, p. 5.)

of the threadworms. Acting on this syllogism (which has, however, failed to convince the worms themselves), learned medical men of all times have had recourse, over and over again, to most dangerous drugs and measures, with results often more disastrous to the sufferer than to his unwelcome guests. And this state of affairs still continues.

II. THE THREADWORM IN MEDICAL LITERATURE.

From the earliest times onward, a host of medical writers¹ have dealt with the threadworm, and indeed it is almost inevitable that this should have been the case. The disease due to the parasite was known so long ago, even to the laity, and, being particularly common in children, was so frequently brought to the notice of physicians, that any man who aspired, either to record the medical knowledge of his time or to found a new system of medicine, was obliged to refer to it. Thus from the earliest historical times, we find mention made of the threadworm disease² by physicians who, in many cases, had no claim at all to be regarded as specialists in this branch of

¹ The following are the most important references to the threadworm in old medical writings:—Hippocrates, *Epidem.* II. 1, 3 and *Aphor.* III. 26, also *Morb. mulier.* II. 187, *Epidem.* IV. 10 (ἐλμίνθια); Aristotle, *De animalibus historia*, V. 94; Discorides, *Euporista*, II. 68 and *Mat. med.* IV. 38; Galen (Edit. Kühn), V. 695, X. 1021; (*Method. med.* Lib. XIV.), XII. 6, XIV. 755 (*Isagoge*), XVII. B. 635, XVIII. B. 138, XIX. 86; Erotian (Edit. Klein), pag. 40, 19; Caelius Aurelianus (*Chron.* IV. 8 and 9); Oribasius (Edit. Daremberg), II. 216 and 245, IV. 572, V. 764; Alexander of Tralles, II. 597 (Edit. Puschmann); Aetius, *Tetrabibl.* III. Serm. I. cap. 41; Leo Philosophus, V. cap. 16; Paulus Aeginet, I.-IV. cap. 58 (Edit. Basil, 1538); Theophanus Nonnus, cap. 172; Michael Psellus, p. 241 (Edit. Ideler);

Joannes Actuarius II. 407 (*ibid.*). (HUBER, J. C., *Bibliographie der Klinischen Helminthologie*, München, 1891, pp. 202, 203.)

² The following is PHELSUM'S quaint description of the threadworm disease, which he calls *Morb. ascaridosus*:—“Die Springwürmerkrankheit (*morb. ascaridosus*) halte ich also vor eine Hinderniss derenjenigen Handlungen und Geschäfte, die einem gesunden Menschen eigen sind, welche entweder von der Bewegung der Springwürmer, welche die Runzen oder die Falten, und die Nervchen, als die Werkzeuge des Gefühls, der Gedärme reizen, und angreifen oder von ihrer allzu grossen Freschhaftigkeit, da sie mehr Schleim, als sein soll, verzehren, verursacht und erzeugt worden.” (PHELSUM, M. VAN., *Pathologische Geschichte der Springwürmer*, Gotha, 1782, vol. ii., p. 2.)

medicine, and whose references to the subject are often more curious than instructive¹.

Hippocrates.

It has already been stated that HIPPOCRATES, who flourished in the 5th century B.C., refers to the threadworm in his writings². Though he cannot have possessed an intimate knowledge of the details of the disease, yet he knew many of the more important clinical phenomena. He even appears to have been cognisant of the fact that threadworms sometimes creep into the vulva and vagina, and cause unpleasant symptoms such as vulvitis, vaginitis, leucorrhoea, and masturbation.

Dioscorides.

DIOSCORIDES, whose knowledge of *Materia Medica* is inferior to none in antiquity, in his "*Euporista*," written about the end of the 1st century A.D., recommends the application of rancid fat for the local irritation due to worms. Internally, he advises the use of *Calamintha*, a plant, the identity of which is somewhat in doubt. According to SPRENGEL, it is the *Melissa Cretica* of the natural order, *Labiatae*, which, the most recent authorities declare, has no medicinal action whatever.

Galen.

GALEN, the most revered of ancient physicians, whose system of medicine ruled the medical world with autocratic sway for fourteen centuries, also mentions the threadworm repeatedly in his writings. GALEN describes the worm as being very similar to large insect-larvæ (σκώληξι), and assumes that its habitat is the rectum. As regards treatment of the disease, he is somewhat guarded, but he confesses that the

¹ It is well known that worms were once supposed to be sent as a punishment for sin, and this was in all seriousness repeated by medical men:—"Wissen wir doch aus den heiligen Büchern, dass Gott sich der Würmer bedient, die Laster der Menschen damit zu bestrafen. Herodes, weil er sich göttliche Ehre anthun liess, musste sich gleich drauf bey lebendigen Leibe in seinem Purpur von den

Würmern verzehren lassen, die ohnstreitig aus seinem königlichen Leibe gewachsen waren." (KRATZENSTEIN, C. G., *Abhandlung von der Erzeugung der Wuermer im Menschlichen Cörper*, Halle, 1784, p. 4.)

² "Hippocrate croyait à la génération spontanée des vers formés, disait-il, de la putréfaction et de la surabondance du lait et du sang dans les enfants." (FUCHET, B., *op. cit.*, p. 15.)

latter requires much more carefully considered measures than the complaint due to the round worm (*Ascaris lumbricoides*), which ranks after the threadworm in frequency. Lastly, GALEN confirms the virtues of the *Calamintha*, praised by DIOSCORIDES, for expelling the helminths.

Mediæval Authors.

References to the threadworm disease may further be found in almost all works which have been handed down to us from medical writers of the Middle Ages, but nothing of special value is to be learned from them. The majority contented themselves with repeating the teachings of GALEN and, incidentally, the observations of HIPPOCRATES and DIOSCORIDES; for it must be remembered that, during this period, GALEN was almost venerated by the medical faculty, and no one ventured to question his authority on any point¹, however trifling. In consequence, no more progress was made in this field of medicine than in any other².

Oribasius and others.

In this superficial way, ORIBASIUS, who acted as Court Physician in Rome about A.D. 400, speaks of the malady associated with the threadworm. Similarly, ÆTIUS and ALEXANDER OF TRALLES, who both wrote in the 6th century, had most quaint notions of the disease. PAULUS ÆGINETA and THEOPHANES NONNUS record the opinions prevalent in the 7th century. Five hundred years afterwards, the writings of MICHAEL PSELLUS show that in this interval medicine had remained absolutely stationary. JOHANNES ACTUARIUS, who

¹ Paracelsus, in his strictures on the followers of Galen, refers specifically to their neglect of worm diseases:—"Proposui de quibusdam tractare simplicibus, et præsertim de quibusdam animalibus, et morbis ad quos pertinent, quorum nullus medicus ante me fecit mentionem hætenus, puto quod ignorarint, aut si forte noverint, ea contempserunt sic ut in oblivionem transierint." (PARACELSUS, A. P. T., *Liber de vermibus*, München, 1570, p. 409.)

² The following may be read as a fair specimen of 17th century medical writings on the subject:—"They may have their origination in us by contagion, from certain animated effluviæ, or vermicular atome-like Corpuscles or Ferments, which flow out of gross, corrupted bodies, and fly through the Air, whereby they are communicated to bodies capable of, and fitted to receive such impressions." (RAMESEY, N., *Some Physical Considerations of . . . Wormes*, London, 1668, p. 9.)

practised as a physician about the end of the 13th century, also makes mention of the threadworm; and if we look to the East and the Arabian physicians, we find that AVICENNA, the foremost among them, is unable to enlighten us any further on our subject.

The Golden Era of Helminthology.

What may be called the Golden Era of medical literature dealing with verminous diseases in general, and the threadworm in particular, included the 18th century and the early part of the 19th. During this period, PALLAS, BLOCH, MÜLLER, GOEZE, ZENKER, RUDOLPHI and BREMSER had elevated Helminthology to the rank of a science, and vast numbers of medical authors followed in their train with treatises, observations and dissertations on the clinical¹, and the then-accepted therapeutical aspects of the subject. When, however, medical men press into their service discoveries which have been made in other branches of science, the latter inevitably become exaggerated and distorted beyond recognition. And what happened in this instance proved no exception to the rule.

Its Effect on Medicine.

Soon the minds of pathologists became obsessed with the idea that worms played a part in practically every disease², and worm-pathology assumed proportions far in excess of its real importance³. Monographs were devoted to every known

¹ English medical men had their share of these treatises, as shown by the following appreciation:—"Dr. Hooper, in the fifth volume of the *Memoirs of the London Medical Society*, published in the year 1799, gives a very excellent paper on the five species of worms which are found within the intestinal canal of the human body." (RHIND, W., *A treatise on the nature and cure of intestinal worms*, London, 1829, p. 3.)

² "Au XVIII^e siècle, toute maladie accompagnée de vers était une affection vermineuse." (FIDÉLIN, P., *Des accidents produits par . . . les oxyures vermiculaires*, Paris, 1873, p. 4.)

³ It is to these exaggerations that the subsequent neglect of, and contempt for, worm-pathology has frequently been attributed:—"Les relations fabuleuses de certains auteurs, leurs observations et leurs notions peu précises, avaient fait tomber la plupart des modernes dans un scepticisme qui avait pu les conduire jusqu'à rayer les affections vermineuses du cadre nosologique. Ainsi Rudolphi, Bréra, Bremser, qui se sont spécialement occupés de ces maladies, pensent qu'il ne faut pas attacher une trop grande importance aux helminthes quand il s'agit de déterminer la cause d'une maladie." (FIDÉLIN, P., *ibid.*, p. 5.)

species, including the threadworm¹, known, until the time of BREMSER, as *Ascaris vermicularis*. Every kind of inflammatory disease, especially when accompanied by destruction of tissue, was ascribed to worms². In every ailment of childhood, worms figured as an ætiological factor. Curious treatises on verminous ulcers were read before learned bodies, and a peculiar condition of the intestinal walls, named *Morbus Mucosus*, was believed to be intimately related to the presence of worms. The latter were also thought to be largely responsible for enteric fever, while the "worm-epidemics" which were described as having occurred in France³ and Germany⁴ may be regarded as the climax of medical exaggeration in this respect.

Modern Writings.

Since then, during the last hundred years, the references to the threadworm, either from a clinical or a therapeutical standpoint, have become too numerous to particularise.

¹ The best known books, dealing mainly with the threadworm since 1728, are :—

COULET, STEPHANUS, *Disputatio medica inauguralis de ascaridibus et umbrico lato*, Lugduni Batavorum, 1728;

Same author, *Tractatus historicus de ascaridibus et lumbrico lato*, Lugd. Bat., 1729;

FIDÉLIN, P., *Des accidents produits par . . . les oxyures vermiculaires*, Paris, 1873;

PEREBOOM, N. E., *De ascaridibus*, Franequerae, 1791;

PHELSUM, M. van., *Naturgeschichte, und Pathologische Geschichte der Springwuermer*, Gotha, 1781, 2. (German translation of the Latin original, which is almost obsolete);

POMPER, A., *Beitrag zur Lehre von Oxyuris*, Berlin, 1877;

TERSON, S., E., *De l'oxyure vermiculaire*, Paris, 1858;

ZUMBUSCH, JULIUS, *De diagnosi atque therapia symptomatum oxyuri vermiculari effectorum*, Gryphiae, 1865.

² An early 18th century writer, HUMMEL, ascribes most diseases to worms, but thoughtfully concedes

that the idea of toothache being caused by a worm is a fallacy :—

"Vermes extra intestina geniti oriuntur in capite, auribus, nariibus, hepate, corde, etc., ingentesque producunt morbos. Atroces dentium dolores non a vermibus producuntur. Vermes cordis saepe efficiunt mortes subitaneas. Canceri seu carcinomata sunt plena parvorum vermium qui rodunt fibras partium. Hydrops aliquando a vermibus potest oriri." (HUMMEL, J. B., *Helminthologia Intricata*, Tubingae, 1724, pp. 23, 24.)

³ "Aussi trouve-t-on à cette époque, des épidémies plus ou moins meurtrières qui ont envahi diverses provinces de France, et qui furent attribuées à la présence des vers." (FIDÉLIN, P., *op. cit.*, p. 4.)

⁴ "Mentionnons surtout l'épidémie de fièvre putride vermineuse observée au Gros-Thail, dans le Roumois, par Lepecq de la Clôture, médecin normand (1769), et la plus célèbre de toutes, celle qui a régné à Goettingen, durant les années 1760 et 1761, et dont la relation nous a été laissée par Roederer et Wagler." (FIDÉLIN, P., *op. cit.*, p. 4.)

Thousands of medical writers have dealt with it at varying length, but they have added very little, if anything, to our real knowledge of the malady¹, or of its treatment, and, down to the middle of the 19th century, they blundered, without exception, into the fallacy of describing the rectum as the principal abode of the parasite². Up to that time no one had taken the trouble to investigate this point, a clearer knowledge of which would, at least, have rendered obsolete the cruel and useless treatment *per rectum*.

Stricker's Discovery.

It was left for the eminent pathologist, W. STRICKER, to prove the traditions of the past to have been erroneous. By means of repeated dissections, he convinced himself that the cæcum, that part of the bowels which intervenes between the small and the large intestine, is the real seat of the disease; and that, in order to deal with it, measures must be taken which will attack the worms in that region. His conclusions were published in 1861³.

These facts have been accepted by all helminthologists, and confirmed by all pathological anatomists, and one might reasonably have expected, not only that the literature on the

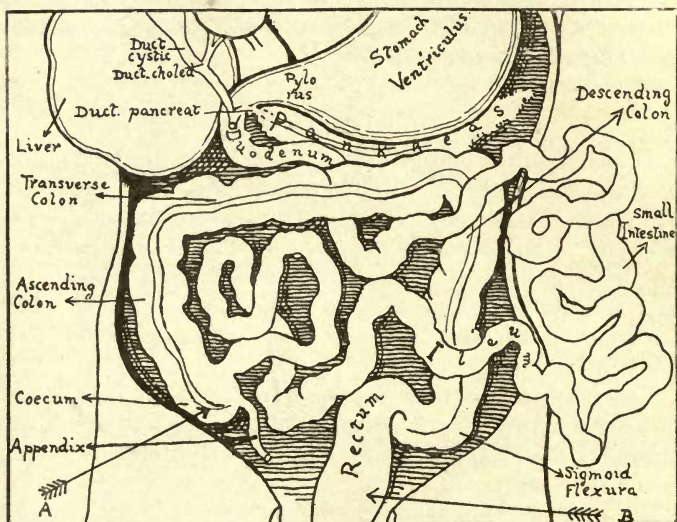
¹ The ambition for originality led some writers to look upon the worms' presence as beneficial:—"Quelques médecins ont voulu prouver, que les vers étaient nécessaires pour la conservation de la santé, alléguant qu'ils étaient un moyen de destruction de prétendus principes de maladies." (PARROT, A., *Dissertation sur les vers intestinaux*, Paris, 1826, pp. 11, 12.) "Clark majora mala illos arcere assumsit, irritatis modice intestinis. Bianchi vero humores pravos ab iisdem absorberi statuit. Tandem Goeze dixit, illos humores superfluos absorbere et consumere." (MULDER, G. J., *Commentatio de entozoïs*, Traj. ad Rhenum, 1823, p. 81.)

² Supposed habitat of thread-worm:—"Habitat in intestino recto, et parte descendente intestini coli; in ipsum autem ventriculum

adscendisse inventi sunt." (MULDER, G. J., *ibid.* p. 14.)

³ "Der Madenwurm wohnt nicht in dem Mastdarm, er entwickelt sich nicht in demselben, weil man nie Junge in dem Mastdarm findet; er bewohnt das Ende des Dünndarms (Ileum) und den Blinddarm. Daher sind die Anthelmintica nutzlos, denn sowohl durch den Mund als in Form von Clysmata gegeben, sind sie zersetzt, bis sie an den Wohnort der Würmer gelangen, welche ausserdem bei ihrer Kleinheit durch jede Darmfalte vor medicamentösen Einwirkungen geschützt werden." (STRICKER, W., *Physiologisch-pathologische Bemerkungen ueber Oxyuris vermicularis* in VIRCHOW'S *Archiv fuer pathologische Anatomie und Physiologie und fuer klinische Medicin*, Berlin, 1861, vol. xxi., p. 360.)

subject would reflect the importance of STRICKER's discoveries, but also that treatment would have been devised on the lines they so clearly indicate. Medical men ought to have recognised that purgatives and enemas were useless, since the anatomical position and character of the cœcum would naturally prevent a thorough sweeping away of the



The arrow A indicates the cœcum, the usual habitat of threadworms in the bowels. B shows the rectum, which is by some still erroneously regarded as their residence. The sketch demonstrates that a very considerable distance separates these two portions of the intestine, and that it is impossible for measures directed to the rectum to have any effect on the parasites in the cœcum.

parasites, and hence new therapeutical principles for combating the disease might have been evolved.

Ignorance of Modern Writers.

But no such revolution has taken place. Indeed, STRICKER's discovery itself is probably to this day quite unknown to many general practitioners who are daily called upon to treat this disease. For down, indeed, to quite recent times, not only minor medical writers, but authors of standard works on medicine have been content to reiterate, one after another,

the antiquated and exploded fallacy of the rectum being the seat of the disease, and to recommend treatment accordingly. This thoughtless repetition throws an interesting sidelight on the manner in which many such books are produced, without even a superficial verification of their contents¹.

Universally ignored in Treatment.

But more remarkable still is the case of writers in whom no such ignorance of the pathological facts exists. They, at least, cannot plead any excuse for the tenacity with which they cling to the routine treatment of the past, in the face of constant and acknowledged failure. One has only to take up the special works of world-wide repute, written during the last fifty years, to deplore the apathy, with which their authors relate how they employed the orthodox measures in the cases that came under their care. Case after case is dismissed as being, unfortunately, incurable. There may be words of regret at the helplessness of modern therapeutics, but the possibility of doing better, along new lines of treatment, is not even contemplated².

¹ The *Nomenclature of Diseases* published by the ROYAL COLLEGE OF PHYSICIANS of London every ten years, in the 3rd edition, published as lately as 1896, still contained the statement that the "rectum is the habitat of *Oxyuris vermicularis*!" But even in the most recent, the 4th edition, 1906, this authoritative work only approaches the truth, without reaching it, by stating that the worm lives in the "rectum and large intestine."

² As an instance, I quote the comments of one of the foremost worm-specialists of modern times, on the treatments which he has

employed for *Oxyuris*:—" . . . the results are not entirely satisfactory, for the disorder is capricious, and constantly liable to return, even after your success appears to be complete. . . . Though, in deference to the statements of practitioners abroad, I have often employed santonin, podophyllin, and chenopodium, the latter both in oil and powder, I am bound to say that any good results following their use generally appeared to me to be principally attributable to the aperients employed to increase their action." (COBBOLD, T. S., *op. cit.*, p. 100.)

III. THE THREADWORM IN ZOOLOGY.

The threadworm has suffered many vicissitudes at the hands of zoologists of all times, and even to this day its exact biological status is by no means firmly established. But, technicalities apart, three broad phases may be distinguished in the history of the threadworm. They are marked off by the answers given, in each period, to two main questions which could not fail to present themselves to observers :— (1) How, and where, does the worm originate ? and (2) Is its presence in the human body an essential condition of its life, or a mere incident ?

The First Phase :—

In the first phase, the parasite was thought to arise *de novo* in the human fæces, as the product of decomposition¹, which might take place either in the intestine or outside². Such an origin, known as *generatio equivoca*³, or “spontaneous generation,” was attributed to many of the lower animals, and this view held the field down to comparatively recent times. In the light of present-day knowledge, it seems, at the first glance, difficult to believe that scientists ever accepted such a theory. The comparatively high development and great specialisation of the organs of *Oxyuris* prove to us that the species must have gone through a period of evolution extending over countless generations ; and the idea of so highly organised a creature springing into existence out of nothing, as it were, would appear preposterous to the most elementary student of modern

¹ *Oxyuris* was supposed to spring from decomposing milk :—“Circa quæ vermium genera notandum, quod parvitenues ex lactis præcipue corruptione generari possint.” (EYSSSEL, M. A., *De febre infantum putrida*, Erfurti, 1693, p. 11.)

² “Veteres medici vermes intestinales ex putredine, seu ex materia spissa caloris atque motus intestini ope nasci, arbitrati sunt.” (HINZE, P. E., *De febris . . . Verminosis*, Helmstadü, 1780, p. 7.)

³ Some authors credit Egypt with being the birthplace of the hypothesis of spontaneous generation :—“Die unzählliche Menge von Mäusen, die bei ihnen (*i.e.*, den Egyptern) gemeinlich nach der Ueberschwemmung des Nilflusses durch die Sonnenhitze aus dem Schlam ausgebrütet wurden, konnte ihnen zu dieser Meinung leicht Gelegenheit geben.” (KRATZENSTEIN, C. G., *op. cit.*, pp. 6, 7.)

biology. But it must be borne in mind that the older zoologists, having no microscopes, were not acquainted with the complex structure of the creature; and further, that the conception of evolution itself had not been evolved, and consequently exercised no control over any theories or hypotheses which might be advanced.

From Aristotle to Harvey.

As early as the 4th century B.C., ARISTOTLE, in his "History of Animals," stated that "the Ascarides¹"—the name given to the threadworm by the Greeks—"spring from the human excrements²"; and until the 17th century A.D., all naturalists subscribed to his opinion, without question³. To WILLIAM HARVEY, the discoverer of the circulation of the blood, is due the credit of having given the death-blow to the theory of "spontaneous generation" by his celebrated maxim: *Omne vivum ex ovo*. This phrase, literally "every living thing comes from an egg"—really means: No living thing can come into being except by direct descent from another individual of the same or of a very similar kind; a doctrine which was destined to have the most far-reaching effects on the whole science of biology.

The Second Phase:—

The second phase was much shorter, lasting from the 17th century down to the second decade of the 19th, when BREMSER published the results of his researches. During this period,

¹ The origin of the name is graphically explained by JORDENS:—"Der von *σκαριζειν* (springen, tanzen), hergenommene Geschlechtsname *ασκαριδες* passt vorzüglich auf diese Gattung, welche überaus unruhig und lebhaft in ihren Bewegungen sind und, wenn man ihnen ein Licht vorhält, wohl einige Zoll weit springen." (JORDENS, D. J. H., *Entomologie und Helminthologie des menschlichen Koerpers*, Hof, 1802, vol. ii., p. 20.)

² In this much-quoted passage, Aristotle says:—"... τὰ δ' ἐν θριξί ζώων, τὰ δ' ἐν σαρκὶ τῶν ζώων, τὰ δ' ἐν ταῖς περιττώμασι, καὶ τούτων τὰ μὲν ἐκ κεχωρισμένων, τὰ δ' ἐτι ὄντων ἐν

τοῖς ζώοις, οἷον αἱ καλούμεναι ἐλμινθες. ἐστὶ δ' αὐτῶν γένη τρία, ἥ τ' ονομαζομένη πλατεῖα, καὶ αἱ στρογγύλαι, καὶ τρίται αἱ ἀσκαρίδες, ἐκ μὲν οὐδ' τούτων ἕτερον οὐδεν γίγνεται." (ARISTOTELIS *De animalibus historia*, Textum recognovit L. DITTMAYER, Lipsiae, 1907, p. 187.)

³ The following is a gem of medical dialectics on this point:—"Vermes in eo loco generantur, in quo excrementa colliguntur, minime in loco ubi fit concoctio. At excrementa colliguntur in intestinis; concoctio fit in ventriculo. Ergo in intestinis generantur, non in ventriculo." (CAM-POLONGUS, ÆMIL., *Tractatus de vermibus*, Paris, 1634, cap. II.)

the belief that the animal arose by spontaneous generation gradually lost ground, under the influence of HARVEY's teachings and REDİ's famous experiments¹. At the same time, much discussion centred round the idea that the thread-worm did not necessarily inhabit the human intestine only², but was really a free-living animal capable of continuing its existence inside man, once it had entered the latter.

Worms in Intestine—Accidental Migration,

LINNAEUS, himself, was amongst those who adopted the view that the presence of worms in the human intestine was always due to accidental migration into the human bowels of animals, which, normally, would be found living outside³. Damp earth, stagnant water, rotting trees, dirt, etc., were considered the usual habitats of all helmintha, and it was thought that these ideas were confirmed by the prevalence of

¹ These experiments are described by their author as follows:—"Je préparai six boîtes sans couvercles: Je mis . . . dans la troisième deux livres de veau; . . . Le lendemain il y avoit des vers dans ces différentes substances . . . je mis de la viande . . . dans un fort grand vaisseau, que je couvris d'une gaze d'Italie, et que je renfermai dans une espèce de garde-manger, entouré de la même gaze: je ne vis jamais un seul ver sur cette viande." (REDİ, F., *Expériences sur la Generation des Insectes*, Paris, 1758, pp. 418, 422.)

² FUCHET mentions some of the most prevalent, often quite fantastic, theories:—"Après la découverte du microscope et les nombreuses expériences qui la suivirent, on pensa que parmi les animaux jusqu'alors inconnus, plusieurs étaient susceptibles d'une véritable conversion en vers intestinaux. Telle était l'opinion de Hoffmann, de Boerhaave.

"Bientôt cette nouvelle explication tomba pour faire place à une autre, plus invraisemblable

encore, c'est l'emboîtement des germes. Valisnieri, chef de cette nouvelle secte, soutint que les vers, aussi anciens que le genre humain, naissaient avec l'homme, et remontaient jusqu'à Adam et Eve, dont les ovaires renfermaient en même temps, et le germe de tous les hommes, et ceux de tous les helminthes. Bloch a émis et soutenu par beaucoup de raisonnemens à peu près la même opinion, ou l'innéité des vers.

"Andry, Bréra, et la plupart des physiologistes pensent aujourd'hui que les germes des helminthes existant hors du corps de l'homme, introduits dans ses organes avec les alimens, ou par la voie de l'absorption, y trouvent des circonstances favorables à leur nutrition, s'y développent, et s'y perpétuent." (FUCHET, B., *op. cit.*, p. 15.)

³ "Immo alia quoque animalia in corpore humano reperta sunt, serpentes, augues, ranae, bufones, araneae, lacertae ac mures." (THEIL, M., *De vermibus canalem intestinalem obsidentibus*, Erfordiae, 1770, p. 4.)

the disease in children, who would be more apt to contract it from such sources¹.

Other Curious Theories.

This theory of accidental migration could not fail to give free play to the imagination² of a period which was more remarkable for verbose arguments than for close observation³. One naturalist maintained that threadworms were young serpents, which, given the circumstances, crept into the rectum per anum, implying that they were quite capable of growing into adult specimens.

¹ KRATZENSTEIN describes the process with evident delight:—"Die . . . Ascarides . . . trifft man mehrentheils nur im Mastdarme an. Sie sehen ebenso aus, als die Maden von denenjenigen Fliegen, welche ihre Brut in die Excremente der Menschen werfen. Es lässt sich daher gar leicht begreifen, auf was vor eine Art diese ungebetenen Gäste in die Gedärme kommen. Viele Leute haben die seltsame Gewohnheit an sich, dass sie ganze Viertelstunden auf den heimlichen Gemächern in den tiefsten Betrachtungen sitzen bleiben. Wie leicht ist es als denn nicht, dass eine Fliege unterdessen ihre Brut an den Mastdarm wirft, welche hernachmals weiter hineinschlupfen und sich in die Gedärme festsetzen. Hieraus lässt sich auch erkennen, warum sie bei Kindern so häufig anzutreffen sind." (KRATZENSTEIN, C. G., *op. cit.*, pp. 28, 29.)

² All the superstitions of mediæval medicine on the ætiology of disease seem to have been collected in the lines given below:—"Quae autem causa sit vermium efficiens continens, atque proxima, ita clarum non est, contentionis seram inter se trahentibus tum physicis tum medicis. . . . Alii cum Averrrohe ad lumen coeleste se recipiunt. Nonnulli cum Scoto ad Deum solum: cum Avicenna vero ad coeli calorem confugiunt. Albertus Magnus ad

motum coeli; Thomas ad occultas influentias, Fernellius ad animam mundi, Platonici et Thomistae autem ad animam terrae et aquae se recipiunt. Cum Cicerone et Seneca qui faciunt, hi putredinem accusant." (AYERUS, I. G., *De Vermibus Intestinorum*. Jenae, 1670, p. 13.)

³ RUDOLPHI criticises the errors of his predecessors regarding the threadworm in detail:—"In nullo fere verme describendo tot errores commissi sunt: Reditus (Anim. XIV., tab. X., fig. 5) muscae larvam, eandemque, quam Jördens Ascaridem Conostoma dixit, pro Ascaride vermiculari vendidit; Couletus (Bibl., n. 340). Taeniae Solii articulos singulos pro Ascaridibus habuit, van Phelsum plurima de verme nostro hariolatur, et Wernerum tamen, virum ceteroquin magna laude dignum, ad errores suos repetendos incitavit; neque cl. Brera, qui vermem rugosum et lineam latum dicat, ipsum vidisse videtur. Qui cum Linnaeo, Ascaridem pollicarem usque fieri asserunt, alio certe cum verme, vel Tricocephalo abrupto, vel Ascaride lumbricoide, confundunt. Froelich cum specie insequente, eidem proxima, at distincta (quod licet Ascaris oblevata), miscet." (RUDOLPHI, C. A., *Entozoorum, sive vermium intestinalium historia naturalis*, Amsterdam, 1808-10, vol. ii., pp. 154, 155.)

Other biologists, from the similarity of their appearance believed them to be identical with the maggots found in cheese¹, and, for this reason, some physicians condemned cheese as an article of diet. The fact that the cheese-maggot is merely the larval stage of a fly was not then known, but it is worthy of note that some authors advanced the idea that threadworms were merely the larvæ of certain other insects, and in particular, those of the common house-fly, to which they bear some superficial resemblance².

Linnaeus.

LINNAEUS re-established the threadworm's claim to be regarded as a true species³, and in his system of classification⁴, he gave it the generic name—*Ascaris*, adding to it the specific designation—*Vermicularis*, in contradistinction to *Ascaris lumbricoides*, the round worm, the only other species of *Ascaris*⁵ he mentions. The fame of LINNAEUS, as the first man to systematise Natural History by applying an orderly classifi-

¹ "Hos animalculis in caseo degentibus similes fuisse creditum est. Hoc autem aegri cujusdam historia a Cl. v. Swieten memorata probare videtur, qui nunquam non, postquam caseum degustasset, hos una cum faecibus secundum circiter diem excernere solebat." (PALMER, J. F., *Tentamen medicum inaugurale de vermibus intestinorum*, Edinburgi, 1766, p. 24.)

² "Fliegenlarven sowohl, als einzelne Glieder des Kettenwurms haben schon dafür gelten müssen." (BREMSE, J. G., *Ueber lebende Wurmer im lebenden Menschen*, Wien, 1819, p. 81.)

³ LINNAEUS knew only eleven species of intestinal worms, but this number was soon greatly increased:—"Linné kannte ii. Species von Eingeweidewürmern, Gmelin (in der 13-ten Ausgabe von Linnei *Systema naturae*) 292, Zeder 391, und Rudolphi endlich beschreibt deren 1100." (NORDMANN, A. VON, *Mikrographische Beitræge zur Naturgeschichte der wirbellosen Thiere*, Berlin, 1832, pp. 5, 6.)

⁴ LINNAEUS' classification was most elementary, and even behind his own times:—"Die wenigen runden Eingeweidewürmer, welche bis zu Linne's Zeiten im menschlichen Körper entdeckt waren, wurden in seinem System in eine Gattung unter dem Namen, *Ascaris*, zusammengeworfen, ohne dass auf die Beobachtungen und Entdeckungen eines Redi und Pallas die gebührende Rücksicht genommen worden wäre; es enthielt sehr von einander verschiedene Eingeweidewürmer." (ZEDER, D. J. G. H., *Anleitung zur Naturgeschichte der Eingeweidewürmer*, Bamberg, 1803, pp. 93, 94.)

⁵ Other authors confined the name *ascaris* to the threadworm, calling the round worm *Lumbricus*:—"Ascarides . . . vix digiti lati longitudinem excedunt, suntque albissimi et agilissimi, unde etiam nomen accepisse apud Graecos videntur. (DRAUTH, S. DE, *Dissertatio inauguralis medica de animalibus humanorum corporum infestis hospitibus*, Halae Magdeburgicae, 1734, p. 40.)

cation to the masses of crude facts then known, caused the name *Ascaris vermicularis* to be generally accepted until early in the last century.

Pallas, Goeze, Rudolphi, and others.

LINNAEUS' knowledge of worms was, however, but slight—not, indeed, far in advance of that of ARISTOTLE. But contemporaneously with, and soon after him arose a number of zoologists, who threw themselves with scientific fervour into the study of this division of the Animal Kingdom; and, with startling rapidity, the gaps in the knowledge of the subject were filled up. And thus the careful and laborious work of PALLAS¹, MÜLLER, FABRICIUS, BLOCH², GOEZE³, and ZEDER culminated in the *Systema Entozoorum* of RUDOLPHI; which marked the greatest advance that had yet been made in this branch of Natural History.

The Third Phase:—

The third phase supplies final answers to the questions which had baffled all previous enquirers. It opens with the demonstration of the bi-sexual character of the animal by BREMSER⁴, who first described male specimens, which, owing

¹ PALLAS, P. S., *Dissertatio medica inauguralis de infestis viventibus intra viventia*, Lugduni Batavorum, 1760.

² BLOCH was the first who tried to bring some sort of order into the science of intestinal worms proper:—“Der selige D. Bloch war der erste, welche die Eingeweidewürmer in Ordnung zu stellen suchte; er theilte sie in zwei Familien, in breite und runde Würmer ab. Allerdings sind die Eingeweidewürmer entweder breit oder rund; aber nach diesen Merkmalen lassen sie sich nicht abtheilen. . . .” (ZEDER, D. J. G. H., *op. cit.*, p. 16.)

³ GOEZE attempted to group intestinal worms into several orders, and he also first described, as far as he could make out, the internal structure of the threadworm:—“Die grosse Anzahl von Spulwürmern machte es allerdings nothwendig, sie in mehreren Abthei-

lungen unterzubringen. Göze versuchte es zwar, aber seine Abtheilung beruht auf der Grösse der Spulwürmer” (ZEDER, D. J. G. H., *op. cit.*, p. 100):—“Though Van Phelsum has treated at large of this worm, but Goeze has all the merit of teaching us its internal structure.” (BRERA, V. L., *A Treatise on verminous diseases*. (Translation) Boston (Mass.), 1817, p. 50.)

⁴ BREMSER relates the facts in the following words:—“. . . die Spulwürmer (*Ascarides*) sind durchgehends nach beiden Enden verschmächet (*attenuatae*) und zeichnen sich durch drei deutliche Warzen oder Knötchen am Vorderende von allen übrigen Rundwürmern auf das bestimmteste aus. Die Pfiemenschwänze (*Oxyurides*) sind zwar nach vorne verschmächet, nach hinten aber pfriemenförmig (*subulatae*), wenigstens die Weibchen und überdies gehen ihnen die drei

to various reasons, had before entirely escaped notice¹. BREMSER, thereby, once for all, dispersed all doubts as to the threadworm's mode of reproduction².

The Threadworm included among Oxyurides.

He further separated it from the rest of the *Ascarides*, and, on morphological grounds, included it in a newly-formed genus, *Oxyuris*³. To this, RUDOLPHI, the leading helminthologist at the time, assented, BREMSER having, long before their publication, communicated his observations to RUDOLPHI⁴. Since then, the threadworm has, almost without challenge⁵,

Knötchen am Kopfende ab. Der innere Bau beider ist nicht minder verschieden. Ich theilte meine Bemerkungen Herrn Rudolphi, dem man doch nicht leicht ein X für ein U machen kann, mit, der auch meiner Meinung beitrug." (BREMSER, J. G., *op. cit.*, p. 82.)

¹ Though first described by BREMSER, the male was actually discovered by SOMMERING:—"Die Männchen wurden schon von Sommering in dem Abgange eines Oelklystieres, womit der berühmte Vater seinem Sohne die Oxyuren abgetrieben hatte, entdeckte und Bremser zugesendet, der sie auch nachher noch, doch nur sparsam fand. Auch Wedl begegnete ihnen nur sparsam, von Siebold hat sie merkwürdiger Weise gar nicht gesehen, welches Letztere auch Dujardin widerfahren zu sein scheint." (KUECHENMEISTER, *op. cit.*, vol. i., p. 283.)

² But the controversy regarding the origin of entozoa in general continued some time longer, as seen below:—"Ce point de l'histoire des vers est malheureusement encore très-obscur. On peut rapporter à deux principales les opinions qui ont été émises pour l'expliquer: les partisans de la première, Hippocrate, Hartsoeker, Spigel, Cabanis, Rudolphi, Bremser, pensent que les vers s'engendrent spontanément dans le corps, sans pré-existence d'oeufs; les défenseurs de la

seconde, Linné, Rhoderer, Wagler, Hoffmann, Bloch, Boerhaave, Van Doeveren, Bréra, croient que leur génération primitive est le résultat du développement d'oeufs ou de germes provenant des humeurs, ou introduits dans le corps au moyen des boissons des alimens, de l'air, etc." (HEMONT, J. M., *Dissertation sur l'histoire naturelle et médicale des vers intestinaux de l'homme*, Paris, 1827, pp. 21, 22.)

³ From the Greek *οξύς* sharp, pointed, and *ούρσ* tail.

⁴ In addition to RUDOLPHI, Bremser's chief supporters on this point were DUJARDIN and KUECHENMEISTER. The former writes:—"Bremser . . . rapporta avec raison cet helminthe au genre Oxyure, d'après l'absence des trois lobes de la tête, qui sont caractéristiques pour les Ascarides. . . . Quant aux ailes latérales attribués par tous les auteurs à la tête de cet helminthe, je puis assurer aussi qu'il y a là simplement un gonflement uniforme, sur tout le contour de la partie antérieure, et non point des ailes membraneuses indépendantes." (DUJARDIN, M. F., *op. cit.*, pp. 139, 140.)

⁵ KUECHENMEISTER states his reasons in detail, thus:—"Ich führe den Wurm als Oxyuris auf, theils aus den schon von Dujardin angegebenen Gründen, weil der Oesophagus und Pharynx dreieckig, der Mund bald rund, bald dreieckig ist, je

passed as *Oxyuris Vermicularis*, the specific name given to it by LINNAEUS being retained.

Rise and Progress of Parasitology.

But, meanwhile, the conception of parasitism as a mode of life peculiar to certain plants and animals had arisen¹, and furnished a complete explanation of the threadworm's presence in the human body². The researches and experiments of KUECHENMEISTER, LEUCKART, GRASSI, CLARAPEDE, COBBOLD, and others, showed that *Oxyuris Vermicularis* could not sustain a separate existence outside the alimentary canal of man. They proved that the eggs could only be hatched, normally, under the influence of the gastric juice; that they would, therefore, perish, unless they reached a human stomach; that to this end Nature had evolved the means³, and that the worm's entire life was spent in the

nach dem Grade seiner Contraction, weil die seitlichen flügel förmigen Anhänge am Munde nur einfach eine einförmige Auftreibung der Kopfpartie und keine wirklichen häutigen Flügel sind, und weil sich am Munde nur 3 Lippen finden, theils wegen der Beschaffenheit der Männchen. . . . Die Männchen nämlich sind im Verhältniss zum Weibchen um sehr vieles kleiner, als dies bei Männchen der ächten Ascariden Statt zu finden pflegt. Sodann bildet das Schwanzende der Ascariden-Männchen meist eine kleine, dem Blatte einer *Sagittaria sagittifolia* ähnliche Fläche, während das Schwanzende des *Oxyuris vermicularis* eine runde Fläche darstellt, in deren Mitte eine Art Saugfläche sich vorfindet. Endlich aber unterscheidet sich der einfache Penis ganz genau durch seine Kleinheit und Form wesentlich von dem meist in doppelter Zahl vorhandenen Penis der Ascarides." (KUECHENMEISTER, G. F. A., *op. cit.*, vol. i., pp. 275-6.)

¹ FRANCISCUS REDI was the first parasitologist:—"Franciscus Redi, physician to the Grand Duke Cosmo III. de Medicis, must be regarded as

the founder of this particular branch of science. In 1708, he published the result of his inquiries, in a volume entitled, '*De Animalculis Vivis quae in Corporibus Animalium Vivorum reperiuntur.*'" (RHIND, W., *op. cit.*, pp. 9, 10.)

² A comprehensive definition of parasitism is supplied by KUECHENMEISTER:—"Parasiten oder Schmarotzer sind selbständige, organisirte, von eigenen thierischen oder vegetabilischen Aeltern abstammende Wesen, die eines zweiten, fremdartigen, thierischen oder vegetabilischen Organismus bedürfen, in oder an dem sie zeitweilig oder dauernd ihre Wohnung nehmen und von dem sie ebenso zeitweilig oder dauernd ihre Nahrung ziehen, um ihre Entwicklung oder ihr Gedeihen, oder endlich ihre Reproduction ermöglichen und vollführen zu können." (KUECHENMEISTER, G. F. A., *op. cit.*, vol. i., p. 1.)

³ The evolution of the habit of parasitism has given rise to many theories, of which I quote the one generally accepted:—"Ne se fixant d'abord sur leurs victimes que pour prendre leur repas, ils en vinrent progressivement à s'installer à

human intestine, in which it grew up, bred, and, in the ordinary course of things, died.

The Rivalry between Parasitology and Zoology.

Parasitology has now become a vast field of research¹, and the parasitic aspect of the threadworm at present overshadows to no small extent the concurrent labours of zoologists proper. Parasitologists have grouped together animals possessing the habit of parasitism in common, though differing greatly in their morphological characters². It may be anticipated, however, that zoologists will, in the near future, re-assert themselves in the domain of threadworm research, by emphasising the importance of its relationship with other non-parasitic forms of life, from a purely systematic point of view. And, through this, biological science is likely to be the gainer³.

demeure sur elles. Sous l'influence d'une alimentation surabondante et d'une sécurité plus grande, l'espèce de ces animaux prospéra et l'habitude du parasitisme s'accrut chez leurs descendants : en même temps, leur caractères se modifiaient plus ou moins profondément par la disparition de tels organes de relation devenus inutiles à un animal fixé, par le développement de l'appareil de fixation, par des modifications dans la taille, etc." (MONIEZ, R., *Les Parasites de l'Homme*, Paris, 1889, pp. 1, 2.)

¹ Parasitologists are constantly adding to the number of parasites known. Thirty years ago no less than 38 genera of parasites infesting the human intestine were described :—"Wir kennen heute nach mehr oder minder genauen Angaben 38 Arten von menschlichen Eingeweidewürmern. . . . Die Rundwürmer oder Nematoden sind in Hinsicht auf Gattungen und Arten am reichsten vertreten. Wir zählen im Ganzen beim Menschen 16 Arten auf 9 Gattungen vertheilt."

(VOGT, C., *Die Herkunft der Eingeweidewürmer des Menschen*, Basel, 1878, pp. 6 and 11.)

² "M. Duméril fait une classe particulière des vers intestinaux ; il leur donne le nom d'helminthes." (TURPIN, V., *Dissertation sur les vers des intestins*, Paris, 1834, p. 6.)

³ The following represents the most recent scientific classification of *Oxyuris Vermicularis* ; but the accepted views on its zoological position are constantly fluctuating :—

SUB-KINGDOM :	Metazoa.
BRANCH :	Enterozoa.
GRADE :	Coelomocoela.
SUB-GRADE :	Invertebrata.
CLASS :	Nemathelmintha.
ORDER :	Nematoda.
(SUB-ORDER :	Meromyariai.)
FAMILY :	Ascaridae.
GENUS :	Oxyuris.
SPECIES :	Vermicularis.

(SHIPLEY, A. E., *The Cambridge Natural History*, London, 1896, vol. ii., pp. 123 *et seq.*, and LANKESTER, E. R., *A Treatise on Zoology*, London, 1900, part ii., pp. i 1 and 2.)

IV. DESCRIPTION OF THE THREADWORM.

Oxyuris Vermicularis is found in three forms¹ :—

1. Mature females.
2. Young females.
3. Males².

This is the order in which they were discovered. It is also the order of their relative size, 1. being the largest and 3. the smallest. But all are visible to the naked eye. The males are now known to be not less numerous³ than the females. But, from their small size and indistinct colour, they are less conspicuous than the females⁴. And it is probable that a large proportion

Oxyuris Vermicularis.
Natural size.
Male on right,
female on left.
(After Eichhorst.)

¹ It is a very curious fact that PHELSUM, the first voluminous monographist of the threadworm, evidently never examined a specimen, and entirely drew upon his imagination for its description :—“Folglich setzt er voraus dass die Struktur solcher Eingeweidewürmer, wie bei andern Thieren beschaffen sei, und dass sie also auch Augen, Nase, Ohren, u.s.w. haben müssen.” (GOEZE, J. A. E., *Versuch einer Naturgeschichte der Eingeweidewürmer im thierischen Koerper*, Blankenburg, 1782, p. 103.)

² A fourth type, generally neglected, also exists, viz., the immature male :—“Eine vierte Vorm, unreife Männchen, übergehe ich, da ich sie bisher nicht gefunden habe, die aber kaum die Grösse eines sichtbaren Punktes überschreiten dürften. Man wird sie an ihrem mehr stumpfen vordern und hintern Ende erkennen.” (KUECHENMEISTER, *op. cit.*, vol. i., p. 278.)

³ At least in the early stages of infection :—“La proportion relative des deux sexes varie . . . aux diverses époques de l'infestation : au début, les deux sexes sont à peu près en même nombre.”

(BLANCHARD, R., *Traité de Zoologie Médicale*, Paris, 1889, p. 716.)

⁴ ZENKER proved that males are comparatively easy to find :—“Dr. Zenker hat nachgewiesen, dass man sie sehr leicht auffinden kann. Er hat mir die Mittheilung gestattet, dass nach seiner Erfahrung überall da reichlich sich Männchen vorfinden, wo man in zahlreicher Menge Weibchen begegnet. Man hat nur nöthig, den Schleim von den Wänden des Dickdarmes mit einem Scalpell abzustreifen und die Schleimmasse auf das Objectglas zu bringen. Besonders gelingt die Sammlung der Männchen, wenn der Dickdarmkoth durch Diarrhöen hinweggespült ist. . . . Schon mit blossen Auge, oder noch besser mit der Loupe, erkennt man nach Zenker, was ich bestätigen kann, die Männchen als kleine, durchscheinende Fädchen oder Riegel, wenn man den auf einer Glasplatte ausgebreiteten Durchfallstuhl und Schleim gegen das Licht hält. Sie wechseln sehr in der Grösse. Zusatz von Wasser ist nicht rathsam, da sie alsdann leicht platzen und einen Prolapsus der Eingeweide erleiden.” (KUECHENMEISTER, *op. cit.*, vol. i., pp. 283, 284.)

of the males die and are swept away in the stools, before the presence of the parasites is revealed by their characteristic symptoms. This accounts for the fact that the earlier naturalists were ignorant of their existence, and believed the worm to be either a-sexual or hermaphrodite.

External Appearance.

General characters :—Like “short pieces of fine white thread.” The body is cylindrical, and shows no signs of segmentation. Head—somewhat pointed, in both sexes. Tail—in the male, blunt or truncated, usually spirally coiled, and the extremity capable of forming a sucking surface ; in the female, the tail tapers to a sharp point, whence is derived the name, *oxyuris*, i.e., pointed tail.

Colour :—Males and young females, pale silver grey ; mature females, opaque chalky white, the colour being due to the distension of the body-cavity by pale-coloured eggs¹.

Mouth :—At anterior end, sometimes triangular, sometimes round, according to its degree of contraction, and furnished with three lips. Two cuticular sacs in this region are distended with clear fluid, and have an appearance which is described as “wing-shaped².”

The anus :—In the female, at the base of the tail ; in the male, the anus, or cloaca, is at the extreme end of the tail. In the latter, the cloaca contains a single spicule, the male organ.

The vagina opens on the ventral aspect of the female, slightly in front of the middle of the animal's length.

Skin.

The skin consists of epidermis and corium. The former is a delicate, structureless membrane, with no cells. The corium is densely fibrous, and marked by four longitudinal seams. During motion it is thrown into broad folds. Transverse striae are also well marked during movement, and the

¹ “If an ordinary full-grown female worm be submitted to microscopic examination, even the employment of the one-inch achromatic objective glass will reveal the presence of a multitude of eggs internally.” (COBBOLD, T. S., *op. cit.*, p. 81.)

² The appendages of the head are sacs of cuticle, probably distended by endosmosis :—“ . . . à tête ailée ou montrant deux renflements latéraux vésiculeux du tégument (produits par un effet d'endosmose ?).” (DUJARDIN, M. F., *op. cit.*, p. 138.)

skin is seen in the form of lateral serrations. But these transverse markings must not be confounded with true segments, being merely due to folding of the loose and inelastic epidermis.

Alimentary System.

The mouth¹ opens into a strong, muscular pharynx, which is thicker posteriorly. At the hinder end, this is separated by a constriction from the oesophagus². Internally, at this spot, there is a chitinous lamella, or diaphragm.

The oesophagus is cylindrical, but its cavity is triangular, with strong cartilaginous seams at the angles. Three powerful, external muscles maintain its triangular form. It is divided by another constriction from the stomach.

The stomach is a very muscular organ. Its cavity is also prismatic, but dilates posteriorly. It is furnished with three strong, pointed, chitinous cones, or teeth. These are embedded in the muscular walls, and their points project into the cavity of the organ.

The intestine is marked off from the stomach by another constriction. It first turns forward; and then runs almost straight to the anus, and nearly in the middle line of the worm. It is but slightly convoluted.

Throughout its length, the alimentary tract consists of three chief layers. These are:—inner and outer (peritoneum) epithelial layers, and a middle muscular layer. An intermediate layer of cells in the intestine have had a hepatic function ascribed to them.

The rectum does not show these three layers, but has muscles which open and close the anus.

Nervous System.

The nervous system is divided into central and peripheral portions, the former including the encephalon, the oesophageal

¹ Various theories have been advanced as to the threadworm's mode of obtaining nourishment — "M. Marchand arrive à ce résultat singulier: que la nutrition s'opère chez les oxyures par la surface externe de la peau, comme celle des Acéphalo-cystes." (GERVAIS and VAN BENEDEN, *Zoologie Médicale*, vol. ii., p. 128.)

² Several observers have attempted to trace breathing-apparatus, but without success:—"Jusqu'ici il a été impossible de déterminer des organes pour la respiration." (PASQUIOT, F. M., *Des helminthes vivant dans le tube digestif*, Paris, 1865, p. 5.)

ring, the ventral cord, and the accessory ganglia. The encephalon, which takes the place of the brain of higher animals, consists of two masses of ganglia, situated on the sides of the oesophagus. From these, two broad cords pass inwards and meet to make up an oesophageal ring, two large branches from which run round the stomach and unite to form the ventral cord.

The ventral cord runs undivided in the male, while in the female it divides and re-unites, to encircle the vagina. Finally, it branches, in both sexes, at the commencement of the rectum, into two large caudal ganglia. A transverse band here completes the anal ring. There is also a large, reniform ganglion at the lower end of the anus. From these ganglia and cords, peripheral branches pass to the various organs of the body.

Muscular System.

The muscular system is very highly developed. Four longitudinal muscles, two dorsal, and two ventral, run the whole length of the animal, just beneath the corium. The different organs are freely supplied with muscle-fibres, but transverse fibres are almost entirely wanting except in the female reproductive organs¹. Between the four longitudinal muscles are four stripes, or bands, known as fat-canals; in young individuals they contain fat, which is gradually absorbed as they reach maturity, but their precise function has not been established.

Reproductive System.

Male :—The semen-forming organ, or testis, is a fairly simple, twisted tube, blind at one end. It occupies the posterior third of the animal, and, winding over the

¹ The musculature of these organs was minutely observed and described by CLAPARÈDE :—"C'est chez l'oxyure de l'homme (*Oxyuris vermicularis*) que nous avons pu étudier le plus commodément les muscles de l'utérus et du vagin. Les fibres musculaires y sont disposées transversalement autour du tube générateur à une certaine distance les unes des autres, et forment des anastomoses entre elles. Ces fibres sont si épaisses qu'elles

font saillie sur le contour de l'organe. On les voit se raccourcir et s'allonger pendant les mouvements péristaltiques du tube générateur. Il est bon de dire que les mouvements péristaltiques de l'utérus et du vagin s'exécutent avec une vivacité toute particulière chez l'*Oxyuris vermicularis*." (CLAPARÈDE, E., *De la formation et de la fécondation des oeufs chez les vers nématodes*, Genève, 1859, p. 18.)

alimentary canal, opens beside, or—as some observers believe—actually within the anus. The male organ is very small, with a hookshaped point, and imperforate. It is grooved along its ventral surface. The sucker on the tail is also regarded as a reproductive organ, being said to assist in the act of copulation.

The seminal cells are very large, epithelium-like bodies, which appear granular.

Female :—The vagina is a simple, oval tube, fairly long and slightly twisted. It merges in the uterus, which is divided into two branches. One branch runs backwards to the anus, bends over the intestine, and then runs forward again as far as the vagina, gradually becoming smaller. The other, shorter, branch runs forward beside the intestine as far as the oesophagus. Here it also bends and returns as far as the vagina. Each branch terminates in fine convolutions containing granular yolk-masses. These terminations, apparently, represent the ovaries.

V. LIFE HISTORY OF THE THREADWORM.

The threadworm is oviparous ; that is to say, the female deposits eggs which are hatched outside the body of the parent. These eggs are minute oval bodies, slightly flattened at one side. The eggshell consists of three layers, except at one point where the middle layer is defective ; and it is said that the embryo makes its escape at this spot¹.

Development within the Egg.

When deposited by the mother, the eggs contain embryos in various stages of development. In some, only the traces of commencing segmentation of the ovum can be found² ; others may have progressed so far as to show already the coiled-up embryo³. But in any case, the process of development of the embryo within the egg is rapid, when the latter has been deposited in favourable surroundings, a certain amount of heat and moisture being the necessary conditions⁴.



Ova of *Oxyuris vermicularis* magnified 275 diameters. (After Eichhorst.) Every adult female contains 10,000 to 12,000 of these eggs.

¹ "L'acide acétique sépare le chorion du reste de la coque, sauf en un point large de 7μ situé à la face dorsale de l'oeuf, en arrière du pôle céphalique : à ce niveau, la couche moyenne de la coque fait défaut, en sort que les deux couches externe et interne entrent en contact. Cette particularité de structure a une grande importance : sous l'influence des acides, du suc gastrique ou de la putréfaction, le point en question se détache à la moindre pression, laissant derrière lui en étroit orifice par lequel l'embryon pourra s'échapper." (BLANCHARD, R., *op. cit.*, p. 712.)

² MAYER states that he has observed spermatozoa amongst the eggs :—"Auch bei *Oxyuris vermicularis* sah ich eine sehr grosse Anzahl von Sammenthieren, deren Länge 1-100 Linie ungefähr betrug, in gekrümmter Gestalt mit zugespitzten Enden,

zwischen den Eiern zerstreut liegen, als diese bei der Berstung des Thieres aus dessen Leibe heraus traten." (MAYER, F. J., *Beitrag zur Anatomie der Entozoen*, Bonn, 1841, p. 6.)

³ The embryos are, as a rule, fully formed within the eggs before the latter are laid :—"D'autres, telles que l'*Oxyuris vermicularis* . . . ne pondent leurs oeufs que lorsque l'embryon est déjà tout formé ou qu'il s'est même dépouillé des enveloppes de l'oeuf. Il ne faut cependant pas attacher trop d'importance à cette époque de la ponte, qui n'est peut-être pas toujours constante chez la même espèce." (CLAPARÈDE, E., *op. cit.*, p. 83.)

⁴ The minimum degree of heat necessary is, according to LEUCKART, about 32° R. ($=104^{\circ}$ F.), which is slightly above blood-heat :—

Hatching—only possible in Human Stomach.

After reaching its full development within the egg, it seems that the embryo may live for a long time, awaiting suitable circumstances for hatching. In addition to moisture and warmth, which are the requisites for its development at this point¹, it appears proved that, normally, hatching is only possible when the egg of the threadworm has reached a human stomach. It is only there, and perhaps also within the duodenum, that an embryo finds such natural conditions as enable it to escape from the shell². If the eggs happen to be deposited by the female in any part of the intestine, hatching does not take place there; they must be swallowed by some human being before this can occur. Unlike many other parasites, *Oxyuris vermicularis* does not have to pass any stage of its existence in another animal, the so-called intermediate host³.

Growth and Maturity.

Therefore, by some means or other, either with food or otherwise, the developed ova must be swallowed by a human being. Arrived in the stomach, the embryos almost at once escape from the ova, when they are tadpole-shaped at first. They quickly pass through the duodenum, jejunum and ileum, and reach the cœcum. On the way they grow rapidly, and

“So verlangen die Eier von *Oxyuris vermicularis* eine Einwirkung von 32° R. Freilich entwickeln die Eier der letzteren schon nach wenigen Stunden, bei höherer Temperatur sogar in noch kürzerer Zeit, einen vollständigen Embryo.” (LEUCKART, R., *Die menschlichen Parasiten*, Leipzig, 1876, p. 73.)

¹ Measurements of the embryo have been made:—“Quand son développement est achevé, l'embryon est long de 140 μ , dont 21 μ sont occupés par la queue: sa largeur maximum est de 10 μ . L'extrémité antérieure est arrondie et large de 8 μ ; la queue est un cône effilé, large de 5 μ à la base. Le tube digestif se voit distinctement à travers la paroi du corps: l'oesophage, long de 42 μ , s'élargit en poire à son extrémité, mais est encore dépourvu de dents; sa lumière

est limitée par une mince couche chitineuse. L'embryon est mobile à l'intérieur de l'oeuf, mais l'activité de ses mouvements dépend de la température.” (BLANCHARD, R., *op. cit.*, pp. 712, 713.)

² Though hatching has been brought about artificially in saliva by some observers, in nature the gastric juice solely performs this office:—“Un embryon gyринiforme . . . ne peut continuer son développement qu'autant que le suc gastrique, en ramollissant la coque de l'oeuf a contribué à le mettre en liberté. L'infestation n'est donc possible que si l'oeuf est ramené dans l'estomac au bout d'un temps variable.” (BLANCHARD, R., *ibid.* p. 721.)

³ “Intermediate host not required.” (COBBOLD, T. S., *Human parasites*, London, 1882, p. 56.

soon assume the adult form, casting their skins several times. In the cœcum they appear, commonly, to remain for some time, frequently penetrating into the appendix¹. Sexual maturity is usually attained in about two weeks², or less³, and the worms breed in the cœcum or, according to some observers, just before entering it.

Further Movements.

Though the cœcum is, admittedly, the principal habitat of the parasite, it is, of course, not entirely confined to that region⁴. Numbers of the worms, both dead and living, pass on through the large bowel to the rectum, and are mostly swept away, from time to time, in the stools. Only a few of the living worms seem to cling for a time to the mucous membrane of the rectum, and to make their presence felt in that region. It is from here that they conduct their well-known nocturnal migrations⁵.

¹ The appendix seems to be the favourable haunt of the male threadworm:—"Les femelles . . . peuvent même pénétrer dans l'appendice iléo-caecal, mais ce dernier semble être le recoin préféré des mâles. . . . En recherchant le sexe des Oxyures trouvés dans l'appendice, Heller a noté: dans un cas 36 mâles; dans un autre cas 19 femelles et 19 mâles; une autre fois, 9 femelles et 30 mâles; dans un dernier examen, 27 femelles et 46 mâles." (BLANCHARD, R., *op. cit.*, p. 721, and footnote.)

² The male matures more rapidly than the female:—"Selon toute apparence, le mâle arrive à maturité sexuelle plus rapidement que la femelle. Un mâle long de 3 millimètres a déjà des spermatozoïdes dans la plus grande partie de son testicule, alors que, chez une femelle de même taille, les organes génitaux sont fort peu développés. Mais quand la femelle a atteint une longueur de 5 millimètres, leur développement s'achève rapidement." (BLANCHARD, R., *ibid.* p. 714.)

³ In this connection GRASSI, who swallowed six female *oxyurides* taken

from the body of a person, who had been dead 24 hours, shows the length to which a naturalist's enthusiasm will go:—"Grassi a voulu répéter sur lui-même cette expérience. Il commence par s'assurer qu'il ne porte pas d'Oxyures, puis avale six femelles prises sur un individu mort depuis vingt-quatre heures; c'était à la fin de janvier, 1879. Au bout de quinze jours, il commence à ressentir du prurit à l'anus et à trouver dans ses selles de nombreuses femelles remplies d'oeufs; il les observe dans chaque selle pendant plus d'un mois." (BLANCHARD, R., *ibid.* pp. 713, 714.)

⁴ Some statements on this point, which are repeated throughout the literature, must be taken *cum grano salis*:—"Brera en a rencontré dans l'oesophage d'une femme morte. Ce même auteur rapporte une observation de Bianchi (mém., p. 181), qui en a vu dans les ventricules du cerveau. Block rapporte que Wulf en a indiqué dans un sac formé dans les parois de l'estomac." (TERSON, S. É., *De l'oxyure vermiculaire*, Paris, 1858, p. 16.)

⁵ A curious explanation which,

Egg-Laying.

As explained before, impregnation generally takes place in the small intestine, or in the cœcum. The male then dies, while the female remains for some time *in situ*, and she may deposit some, or all, of her eggs within the bowel. If that occurs, the ova are passed per rectum, and, as already shown, must be swallowed in order to develop another generation. Even if deposited the eggs are never hatched in the large intestine or rectum, as is clearly proved by the fact that young oxyurides are never found in that situation. Not unfrequently the impregnated female herself, with her ova, is passed in the stools, or she may wriggle out of the anus of her own accord. She then deposits her eggs in some spot, from which they may ultimately be transferred to a human stomach. In many cases she may be even swallowed herself, alive or dead, by an unsuspecting person, when her eggs are set free in the stomach.

Life Duration of Worm.

The number of eggs deposited by one female has been estimated at 10,000 to 12,000, and the life time of a single generation of oxyurides is calculated to be from five to seven weeks. At the end of this period, if no further infection should have taken place in the meantime, the worms die out, with or without medication, and the sufferer is spontaneously relieved of the trouble. But this is a rare occurrence, unless strict hygienic measures have been enforced, and re-infection is apparently the rule, at all events amongst children, in whom it is difficult, if not impossible, to ensure absolute cleanliness.

50 years ago, held the field, suggested that *Oxyuris* was a nocturnal animal:—"Le soir, il est à la partie inférieure du rectum; pendant le jour, à sa partie supérieure.

Il semble donc fuir la lumière, comme Dugès l'avait remarqué." (FIÉVET, J. C., *Quelques mots sur les helminthes de l'homme*, Paris, 1855, p. 16.)

VI. INFECTION AND RE-INFECTION.

In the vast majority of cases, primary infection is due to the patient swallowing the fertilised eggs of *Oxyuris*. These, when deposited by the female, dry rapidly, and are so minute and light that they may actually float or be blown about in the air. They settle on various articles of food, especially those of a vegetable nature. Hence fruit, salads, lettuce, watercress, and all vegetables commonly eaten uncooked, are particularly liable to carry the infection. In some cases, it seems as if even cooking would not destroy the vitality of the eggs, hence worms sometimes appear to be introduced by eating carrots, cabbage and spinach, although they have been boiled.

Filtered and Polluted Water.

Drinking water has been blamed, but many authors cast doubt on this as a source of infection. They say that when the eggs are immersed in water for any considerable time, they swell up, as a result of endosmosis, and burst, and the embryos consequently die before they can reach the human stomach. But, though this statement appears to be true of filtered water, it does not seem to apply to polluted drinking water, the solid contents of which, undoubtedly, may contain threadworm eggs, fully capable of normal development.

Worms Swallowed Whole.

Being so extremely small, the threadworm is sometimes swallowed whole, especially by children, as described in the preceding chapter, and if such a specimen is a female, infection, *per se*, may be caused in that way.

Wholesale Infection of Families.

It has been suggested that infection may also occur directly from rectum to rectum, if a healthy person shares the same bed with a sufferer from threadworms. It is well known that the parasites frequently creep out *per anum* at night, and the supporters of the hypotheses say, if a worm can creep out of one rectum, what is to prevent it creeping into another ?

And if the intruder happens to be a female, with fertilised eggs, these eggs may be easily transferred to the mouth of the individual, who thereby becomes infected in his turn¹.

An Obsolete Theory.

This may be accepted as occurring very occasionally. But the theory of VIX and KUECHENMEISTER, that such a female may deposit eggs in the rectum which may be hatched there, or may creep up higher in the intestine, and there go through a similar process, is no longer defended by any authority. The eggs could not by such means reach the stomach or duodenum, the only places where hatching has been shown to be possible. In any case, wanderings from rectum to rectum must be extremely rare, but there is no reason to doubt that persons living together, and more particularly children, often infect each other in other ways, probably through contamination of fingers, or of clothing, towels and the like, from any of which the eggs may easily be conveyed to the mouth².

Re-infection.

When once infection has taken place, re-infection (or as some call it, auto-infection) is the rule, especially in children, as explained above. The *modus operandi* is as follows:—the irritation caused by the worm, particularly during its nocturnal migrations, leads to violent scratching of the anus and perinaeum, often unconsciously, during sleep. By this means, the worms may be broken up and the ova they contain, or those which have already been deposited, are smeared on the fingers and forced under the nails³. Thus they may easily

¹ Some authors consider it advisable, as a prophylactic measure, to treat the whole of a family, if only one member appears to be affected:—“Vielfach haben wir uns überzeugt dass in kinderreichen Familien oft sämtliche Kinder bis in das jüngste Alter, Oxyuren beherbergen. Bei Abtreibungscuren pflegen wir daher alle Familienmitglieder zu berücksichtigen.” (MOSLER, F. und PEIPER, E., *Thierische Parasiten in NOTHNAGEL'S Specieller Pathologie und Therapie*, Wien, 1894, band vi., p. 228.)

² “Perhaps also flies or their excrement play a part in the distribution of the parasite similar to that demonstrated by Grassi as taking place in the spread of the ova of *Trichocephalus* and *Taenia*.” (BRAUN, M., *The animal parasites of man*; brought up to date by SAMBON, L. W., London, 1906, pp. 339, 340.)

³ “Ordinarily, children become infested by biting their nails, beneath the margins of which the eggs lie concealed. Professors Heller, Zenker, and myself have, all more

contaminate the food, or may even be swallowed directly, if the patient puts his fingers to his mouth. Itching at the nose¹ has been described as a symptom of the disease, and is said to be a frequent cause of such a transference of the ova from anus to mouth. But, by whatever means, the impregnated ova must reach the host's stomach for true infection to occur, and it is impossible to insist too strongly on the importance of this point. Directly they arrive there, a new generation is started, and this vicious cycle may be, and often is, repeated indefinitely for months or years.

Possibilities of Spontaneous Cure.

Whereas, if such auto-infection be prevented by the most scrupulous care and cleanliness, no fresh generation can arise, and the existing one ultimately dies out (spontaneous cure), since the ova cannot be hatched in the bowels of the sufferer, but must be re-swallowed. Upon this fact is based the so-called hygienic, or expectant treatment, which relies on measures of cleanliness only, to prevent auto-infection, and upon control of diet to obviate fresh infection from without. Since these dietetic restrictions must consist in withholding all fresh vegetables and fruit, it is hardly necessary to enlarge on the hardships they involve.

VII. PREDISPOSING CONDITIONS.

Age.

From the earliest time it has been known that this form of helminthiasis is most common in children², and this observation is entirely beyond question³. Indeed, at one time,

or less, frequently had occasion to demonstrate this fact to our patients." (COBBOLD, T. S., *Human parasites*, London, 1882, pp. 57, 58.)

¹ ". . . the troublesome itching . . . is met by scratching and rubbing with the fingers. It is therefore possible, that the eggs may even thus be introduced into the nose. . . . As a matter of fact, the larvae of *Oxyuris* have been found in the nose." (BRAUN, M., *op. cit.*, p. 339.)

² "*Oxyuris vermicularis* may emphatically be called the children's pest." (COBBOLD, T. S., *Worms, a series of lectures*, London, 1872, p. 80.)

³ All intestinal worms attack children in preference to adults:—"Quum omnes intestinorum vermes tum *Oxyuris* praecipue in infantium corpore inesse videtur." (ZUMBUSCH, J., *De diagnosi atque therapia symptomatum oxyuri vermiculari effectorum*, Gryphiae, 1865, p. 7.)

nearly all children's ailments were, for this reason, considered to be in some way connected with "worms¹." The complaint is, however, not by any means confined to them, but may occur at any age, and is, indeed, fairly frequent in old people. Out of 226 bodies in which GRIBBOHM found *Oxyuris*, at Kiel Pathological Institute, the youngest was five weeks old and the oldest 82 years. The same observer discovered *Oxyuris* in the youngest children who were infested with worms², when no other parasite was present³, and thus proved how extremely common the complaint is, especially in very young children, in whom its existence may be entirely unsuspected. It has been stated by many observers, that, as a general rule, the older the patient, the more obstinate the disease.

Sex.

There does not appear to be any marked difference between the sexes as regards liability to threadworm disease. The statistics collected by GRIBBOHM during five years, show that amongst 149 adults found with this parasite, 94 were men and 55 women. These figures point to a slight preponderance of the male sex. GRIBBOHM, however, does not wish to deduce general conclusions from the comparatively small amount of material from which he collected his figures; indeed, he inclines to the opinion that women must be more liable to the disease than men, on the grounds that women mix more with children than men do, and so are more likely to be infected by the former, and further, that women are in the habit of tasting food before it is properly cooked. Older authorities were unanimous in stating that women were more susceptible⁴ than

¹ "Prioribus temporibus omnes fere infantium morbi a vermibus deducebantur." (HELLER, I., *De Helminthiasi*, Berolini, 1838, p. 3.)

² Gribbohm's observations covered the period from 1 November, 1872, to 1 April, 1877, and 1,117 corpses came under observation. *Oxyuris* was found in several children under nine months, whose intestines contained no other parasites. (GRIBBOHM, H., *Zur Statistik menschlicher Entozoen*, Kiel, 1877, p. 6.)

³ The presence of *Oxyuris* even in newly-born children has been maintained:—"M. Gaetzer, dans un ouvrage sur les maladies du fœtus, a prétendu que la présence des vers intestinaux dans le fœtus humain était fort commune. On a plusieurs fois rencontré des helminthes dans les premières selles des nouveau-nés." (FIDÉLIN, P., *op. cit.*, pp. 37, 38.)

⁴ "Frequentiores etiam sunt vermes sexui sequiore, quam masculino, quia sexus sequior magis de

men, on account of their "weaker" constitution, and also because they were more often subjects of the "lymphatic humour"¹ which was believed to favour worms².

Geographical Distribution and Climate.

Climate seems to have very little effect on the frequency of the disease. The parasite is common in all parts of the world, in hot, as well as in temperate and cold climates. It has been identified in such widely separated countries as India³ and Egypt⁴, the West Indies⁵ and Syria⁶. In Anglo-American countries⁷, it is the commonest of all parasites, the *Ascaris lumbricoides* taking the second place. On the continent of Europe, these conditions are reversed. For obvious reasons it might, *a priori*, be expected to be more prevalent among vegetarian races than among flesh eaters, and it has been stated to be more frequent in country districts than in towns,

lymphatico chyloso humore participat." (WEIST, D. S., *De Morbis ex vermibus*, Halae Magdeburgicae, 1725, p. 6.)

¹ "Tous les médecins admettent, en effet, que le sexe féminin a plus de tendance au lymphatisme et à ses conséquences que le sexe opposé." (TERSON, S. E., *op. cit.*, p. 19.)

² "Hoc quidem libenter concedere possumus, quod humores putrescentes generationi vermium admodum faveant." (HINZE, P. E., *op. cit.*, p. 11.)

³ "In the Darbhanga jail the eggs of the parasite (*i.e.*, *Oxyuris vermicularis*) were found in the stools of 9% of the prisoners." (CALVERT, J. T., *Notes on Intestinal Worms*, Calcutta, 1902, p. 8.)

⁴ "Au dire de Bilharz il n'est pas rare de trouver dans les cadavres qu'on ouvre au Caire, quelque milliers d'oxyures agglomérés en pelotons." (DAVAINE, C., *Traité des Entozoaires et des maladies vermineuses de l'homme et des animaux domestiques*, Paris, 1860, p. 212.)

⁵ "In the West Indies . . .

among the negroes (whose diet consists chiefly of vegetables), complaints arising from worms are much more frequent than amongst the white people; insomuch that it is very rare to see a negro child without a swollen belly, and other symptoms of this disease." (CHAMBERLAINE, W., *A practical treatise on the efficacy of Stizolobium, or Cowhage, in diseases occasioned by worms*, London, 1784, pp. 3, 4.)

⁶ "Die Eingeweidewürmer finden sich unter den Bewohnern Syriens und der Nilländer ausserordentlich häufig . . . *Oxyuris vermicularis* . . . findet sich zu Haufen schon in den Gedärmen der Kinder. Unter den Erwachsenen sind es besonders die kachektischen, wassersüchtigen und skrofulösen Subjekte." (PRUNER, F., *Die Krankheiten des Orients*, Erlangen, 1847, p. 244.)

⁷ "This species (*i.e.*, *Oxyuris vermicularis*) is the most common of all the parasitic worms in the Anglo-American." (LEIDY, J., *A synopsis of Entozoa, and some of their ecto-congeners*, Philadelphia, 1856, p. 50.)

and in moist rather than in dry climates¹. But on all these points reliable statistics are wanting. As regards seasons, one author has declared that threadworms are commoner in Autumn, another says in Spring². The statistics of GRIBBOHM and others do not give any conclusive indications of a seasonal influence.

Food.

It has already been stated that the ova of *Oxyuris* are more often swallowed with vegetable than with animal food, especially if the former be eaten uncooked. The eggs, which are floating in the air, settle on vegetables, or they may be conveyed in manure or by sewage water, to the growing vegetables. Thus salads, lettuces, watercress and the like, which are not usually cooked, are specially dangerous, but it appears certain that carrots, cabbages, onions, etc., may convey the infection, even though they are cooked. One author of repute considers strawberries the greatest offenders amongst fruits.

Bodily Condition or Constitution.

Most authorities believe this to be the most important factor amongst predisposing conditions. Nearly all experience seems to show that weakly persons are more subject to infection than the strong³, and this appears to be borne out by the age-distribution of the complaint: children and old people—the greatest sufferers—show, naturally, more susceptibility to morbid influences than adults. This liability to “worms” has been explained as due to a peculiar condition of the gastric juice, which, in those habitually afflicted with intestinal parasites, apparently lacks the power of destroying the embryos of *Oxyuris* as they reach the stomach, within their ova.

¹ “Vermes . . . rusticos prae urbanis . . . aera humidum haurientes . . . prae contrariis infestare creditur; et magna ex parte certum est.” (WALLIS, T., *Dissertatio medica inauguralis de vermibus intestinorum*, Edinburgi, 1784, p. 26.)

² “Besonders zu Ende des Winters scheint die Entwicklung am energischsten vor sich zu gehen,

wenigstens hat man um diese Zeit die meisten an *Oxyuris* leidenden Kranken constatirt.” (BRASS, A., *Die thierischen Parasiten des Menschen*, Cassel, 1884, p. 62.)

³ “L’oxyure vermiculaire se trouve . . . surtout chez les enfants ou les hommes soumis à un régime débilant.” (DUJARDIN, M. F., *op. cit.*, p. 139.)

So obvious is it that a great number of morbid conditions predispose their victims to "worms," that, at one time, these invaders were regarded in the light of symptoms of disease rather than as themselves constituting a disease. Debilitating¹, and cachectic², diseases appear to have a particularly evil influence in this direction, and special mention must be made of tuberculosis, rickets³, diabetes, cancer, Bright's disease, heart-disease and dropsy, and other chronic maladies, whilst morbid states, which were blamed by earlier writers for causing threadworm disease, include suppurating wounds, strangulated hernia, fevers of all kinds, surgical operations, "mucous" and mental diseases⁴.

One distinguished helminthologist of modern times, however, denies that constitutional debility is a predisposing cause, and says that the cachexia and weakness so often observed are results, and not causes, of the disease. He even declares that a robust person makes a better host for the *Oxyuris* than a weakly one, though the latter may be more gravely affected by it. He considers that the notion is a survival of the obsolete theory that equivocal generation of the parasite was favoured by the diathesis of the patient.

This view is, however, opposed to the almost unanimous opinion of other helminthologists⁵. It is well known, for instance, that tuberculous children, whose vitality is admittedly impaired, are found to suffer from threadworms,

¹ "A relaxed and weak stomach affords them (*i.e.*, the worms) a nidus, where they propagate and are nourished." (CHAMBERLAINE, W., *op. cit.*, p. 3.)

² "Neither do I deny them to be oft-times an Effect and Symptome of divers diseases, especially Putrid Feavers, Cachexias, Consumptions, etc., as well as a Cause." (RAMESEY, W., *op. cit.*, p. 369.)

³ "Après l'âge, on a accusé le tempérament phlegmatique, la constitution lymphatique, scrofuleuse, rachitique." (TERSON, S. E., *op. cit.*, p. 19.)

⁴ "Les grandes plaies suivies de beaucoup de suppuration, les hernies étranglées, la plupart des fièvres dites essentielles, les grandes

opérations de la chirurgie, se compliquent très-fréquemment de la présence des lombricoïdes; . . . Roederer et Wagler nous disent que la maladie muqueuse se compliquait souvent d'ascarides. . . . Les affections mentales . . . déterminent souvent la formation de ces êtres parasites." (FUCHET, B., *op. cit.*, p. 17.)

⁵ "Maximi vero momenti tertia est indicatio, scilicet indicatio causalis et curativa. Nam helminthiasis causae potius in organorum digestionis statu pituitoso sunt positae quam in vermibus ipsis, qui tantum status hujus symptoma sunt, et quorum effectus tollitur, si causa est ablata." (HELLER, I., *op. cit.*, p. 29.)

practically without exception. So much is this the case, that at one time it was believed that some mysterious connection existed between "scrofula" and threadworms.

VIII. SYMPTOMS.

Threadworms may be, and often are, present, even in large numbers, without having given rise to such symptoms as can readily be ascribed to them¹, and this is specially apt to occur in children. The latter may sometimes be looked upon by their parents merely as a little delicate. In other instances such children are often retarded in growth or in mental development, pale, peevish, restless, shy and irritable; but none of these signs rouses suspicion of the real cause of their malady, though it is recognised that all is not quite as it should be.

The symptoms of threadworm disease proper are extremely numerous and varied². They may be divided into local and constitutional. The local symptoms include all the morbid phenomena which are directly traceable to, and often merely the mechanical effects of, the presence of the worms. The constitutional symptoms are those which manifest themselves more or less at a distance from the seat of the trouble, and are, probably, all induced by the stimulation which the parasites produce reflexly in the nervous system³. It has been said that this is the most irritating of all the helminths that attack man⁴.

¹ "Cependant il y a des cas dans lesquels les individus, atteints de ces vers, n'ont jamais éprouvé le moindre accident; cela paraîtrait dépendre du siège qu'ils affectent dans l'intestin." (COLIN, P. D., *Aperçu sur le diagnostic des affections vermineuses du tube digestif*. Paris, 1837, p. 16.)

² "Les vers . . . s'annoncent . . . quelquefois par des symptômes qui sont nombreux, variables, fallacieux, et souvent terribles, c'est ce que Pecchlinus (obs. 65, liv. 1), exprime ainsi: nullum dit-il, tam

peregrinum est symptoma, tamque daemoniacum, quod vermes producere non possent." (HÉMONT, J. M., *op. cit.*, p. 27.)

³ "La plupart proviennent du dérangement de la digestion; les autres tiennent à l'altération sympathique des autres fonctions." (PERGAUD, P. P., *Dissertation sur les vers intestinaux*, Paris, 1830, p. 15.)

⁴ "C'est le plus incommode de tous les helminthes de l'homme." (DUJARDIN, M. F., *op. cit.*, p. 139.)

The most prominent local and constitutional symptoms are :—

Changes of Aspect.

The face of the sufferer from threadworms is nearly always markedly pale, or flushes and pales alternately, and usually shows livid or black rings round the eyes. It is also often swollen, especially the eyelids and the upper lip. The pupils of both eyes may be dilated, and their conjunctivæ discoloured¹. The facial expression in children, and often in adults, is downcast and depressed², and, indeed, in very many children, the whole aspect is so striking and characteristic, as to attract the instant attention of a trained observer.

Abnormalities of Appetite.

In children particularly, some change of the appetite is very frequently the first symptom to attract attention. Most commonly the appetite fails, but, on the other hand, it may be voracious³. Moreover, it is noticeable that, even when the appetite is good, bodily nutrition is defective⁴. A capricious appetite is not infrequently noticed. There is a craving for food, even after a meal, or a desire for articles of diet, which are refused when offered, and any such symptoms should be carefully noted.

Abnormalities of Digestion.

There is an increase in the flow of saliva into the mouth ; the patient's mouth is always "watering," and, if a child, it dribbles. The breath is tainted⁵, or even offensive, and the tongue is foul, coated and flabby, and indented by the teeth. Nausea after food is often complained of, and flatulence, eructations, and borborygmi (rumblings) frequently occur.

¹ "Le visage des persons qui sont affectés de vers est changé ; ils sont ordinairement très-pâles . . . les pupilles sont dilatées, et les paupières inférieures entourées d'un cercle bleuâtre." (TURPIN, V., *op. cit.*, p. 13.)

² " . . . le facies vermineux des auteurs : teint terreux ou verdâtre, passant alternativement de la pâleur à la rougeur . . . physionomie triste et abattue." (FIDÉLIN, P., *op. cit.*, p. 36.)

³ "L'appétit varie, tantôt il disparaît entièrement, et tantôt les malades sont très-affamés." (TURPIN, V., *op. cit.*, p. 14.)

⁴ "Optime comedentes aegri, parum vel nihil nutriuntur." (PHILITES, S. C., *Dissertatio inauguralis medica febrium verminosarum pathologiam exhibens*. Göttingae, 1785, p. 34.)

⁵ " . . . l'haleine est fétide." (TURPIN, V., *op. cit.*, p. 14.)

Habitual constipation is the rule, but in many cases there is diarrhœa¹. This may be constant, or chronic², and the stools are sometimes mucous, or even streaked, or mixed, with blood³.

The abdomen is somewhat swollen, and very hard about the navel. The lower part of the belly is hard, tender and cold; and there may be gnawing and burning sensations, or acute colic pains in the intestines. Many patients say that the abdominal pains are relieved by taking food⁴. But, on the other hand, it has been ascertained that the ingestion of certain articles of diet, such as tea and coffee, has an irritating and disturbing effect on the threadworms, and causes exacerbation of most of the symptoms⁵.

Abnormalities of Micturition.

A hypersensitive condition of the bladder is common, leading to increased frequency of micturition; and, in children, this may take the form of nocturnal enuresis, or wetting the bed.

Abnormalities of Nervous Phenomena and Temperament.

The patient shows signs of nervousness, which are apt to be specially marked in children. The temper is peevish, and the child cries on slight provocation. Shivering sensations, biting the nails, boring or picking at the nose, grinding the teeth, low spirits, and a general condition of restlessness, are common symptoms. Palpitation of the heart, and a nervous, or spasmodic cough, are frequently observed⁶. And the

¹ "Iis enim, qui vermibus laborant, incerta alvus est, haud raro stricta, frequentissime laxior." (PALMER, J. F., *op. cit.*, p. 4.)

² "L'inflammation peut se borner à la surface interne de la muqueuse . . . c'est ainsi qu'on peut expliquer . . . ces diarrhées chroniques qui continuent indéfiniment tant que la cause n'est enlevée." (RAYNAUD, H. L., *Quelques cas de colique vermineuse*, Montpellier, 1866, p. 13.)

³ " . . . Les excréments alvins sont glaireux, et souvent teints de sang." (TURPIN, V., *op. cit.*, p. 14.)

⁴ "En général, les douleurs augmentent dans l'état de vacuité des intestins, et cessent après le repas ou après avoir bu de l'eau très-froide." (PERGAUD, P. P., *op. cit.*, p. 16.)

⁵ "Gewisse Speisen, besonders Möhren, Zwiebeln, Früchte, u.s.w., machen die Würmer besonders unruhig, die dann wohl während des ganzen Tages durch das angedeutete Jucken belästigen." (KUECHENMEISTER, G. F. A., *op. cit.*, p. 288.)

⁶ " . . . des palpitations de coeur, la tentence aux syncopes, une toux quinteuse ou convulsive." (FIDÉLIN, P., *op. cit.*, p. 36.)

irritation experienced in the nose may be accompanied by sharp attacks of bleeding from that organ¹.

The dilatation of the pupils, mentioned above, is really due to the disturbances of the nervous system². Amongst nervous symptoms must also be classed the inclination for, and the habit of, self-abuse, which is easily formed by those who suffer from threadworms, and is very difficult to check. There appears to exist an almost overwhelming impulse towards this habit, which, it has been suggested, may be induced reflexly by local irritation of the prostate gland, through the walls of the rectum, to which the former is in close proximity ; or, in the female, also reflexly, by the passage of worms into the vulva and vagina³.

Frequent and uncontrollable night-emissions may be a symptom in some instances⁴.

Abnormalities of Temperature.

In a number of cases the temperature is raised intermittently ; and it is even said that threadworms have led to a mistaken diagnosis of "intermittent fever"⁵.

Abnormalities of Sleep.

Sleep is frequently disturbed⁶. The patient lies awake⁷, or only sleeps fitfully and restlessly. Children have fits of crying, or screaming, on awaking from sleep ; and scratching,

¹ " . . . A cela il faut ajouter . . . des épistaxis fréquentes . . . " (FIDÉLIN, P., *op. cit.*, p. 36.)

² "Nervi enim debilitentur necesse est, si continuis fere spasmodis fatigantur, et optima lymphæ a vermibus consumitur. Et hanc debilitatem nervorum majoris dilatationis pupillæ causam esse existimo." (HINZE, P. E., *op. cit.*, p. 43.)

³ "Qui faisait naître en elles la funeste habitude de la masturbation." (TURPIN, V., *op. cit.*, p. 7.)

⁴ "Une observation très remarquable a été citée par M. Lallemand, dans son ouvrage : les accidents étaient dus à la présence des oxyures dans le rectum. L'incontinence nocturne d'urine, l'onanisme, le saty-

riasis, peuvent, reconnaître la même cause." (FIDÉLIN, P., *op. cit.*, pp. 29, 30.)

⁵ " . . . ils ont produit des accès tellement caractérisés de fièvre intermittente que des praticiens habiles ont été induits en erreur M. Cruveilhier avoue avoir pris pour une fièvre intermittente des accidents périodiques dus à des oxyures vermiculaires." (FIDÉLIN, P., *op. cit.*, p. 24.)

⁶ "Aliquando somnum arcent vermes." (PHILITES, S. C., *op. cit.*, p. 33.)

⁷ "L'irritation qu'ils déterminent peut occasionner . . . une insomnie opiniâtre que l'on ne sait à quoi attribuer chez les enfants." (HÉMONT, J. M., *op. cit.*, p. 12.)

picking the nose, etc., may go on during sleep, as well as when awake. Grinding the teeth is *most marked* during sleep¹.

Disturbances about the Anus, etc.

The most characteristic of all symptoms is itching in, and around the rectum and anus; and this is such strong presumptive evidence that the sign should be specially watched for in children. Even those who are too young to talk will demonstrate its presence by their attempts at scratching. The irritation, which is often almost unbearable², is worse at night, when the migrations of the parasites ordinarily take place³. It may be accompanied by a severe burning, or even pain and tenesmus in the rectum. The perinaeum, scrotum, and the adjacent parts, share in the irritation; and the inevitable scratching induces a condition of *pruritus ani*—the skin becoming moist, sodden and unhealthy; and blennorrhœa of the rectum may occur⁴.

¹ “. . . le sommeil est troublé et souvent accompagné de grincemens de dents.” (TURPIN, V., *op. cit.* p. 14.)

² GERVAIS and VAN BENEDEN quote a graphic description given by a patient of his sufferings:—“Cette maladie en apparence si simple est pour moi un supplice. Chaque soir, entre cinq et six heures, lorsque les premières douleurs se font sentir, je deviens pâle, j’ai des horripilations, je parais troublé; mes camarades s’en aperçoivent facilement; plusieurs fois j’ai eu des frissons. Je ne peux tenir en place; je suis obligé de marcher, de m’agiter; si je suis dans un lieu public, je sors à l’instant et je cours prendre des lavements à l’eau froide qui ne me soulagent pas toujours, et je suis alors au supplice: je me déchire la périnée et les bourses, je suis obligé d’uriner à chaque instant.” (GERVAIS et VAN BENEDEN, *op. cit.*, vol. ii., p. 128.)

³ KUECHENMEISTER describes the worms’ nocturnal wanderings in a

case which he treated:—“Ich habe z. B. einen Schuhmacher in Behandlung, der mich um Rath fragte, da ihm die Oxyuren den nächtlichen Schlaf störten. Sobald er ins Bett kam und warm geworden war, fingen die Oxyuren an aus dem After unter heftigem Jucken auszumarschiren und in der Afterkerbe herumzuwandeln, ja nach seiner Meinung den Versuch zu machen, sich fest zu beissen. Einst habe er als er sich gar keinen Rath gewusst hätte, seine Frau geweckt und gebeten, zu sehen, ob sie nicht entdecken könne, was ihn so plage. Mit Hilfe des Lichtes habe die Frau die weissen Würmchen gefunden und abgelesen.” (KUECHENMEISTER, G. F. A., *op. cit.*, p. 229.)

⁴ “Si vermes in recto nidulantur, pruritus excitant ad anum, tenesmus, imo blennorrhoeam recti et congestiones haemorrhoidales, ita ut alvi excretiones striis sanguineis tinctae interdum sint. . . . In infantibus prolapsus ani oriri potest.” (HELLER, I., *op. cit.*, p. 19, and footnote.)

In female patients¹, inflammation of the vulva and vagina, and leucorrhœa², frequently follow ; and these symptoms are believed to be set up by the passage of the worms into the organs in question³.

IX. DIAGNOSIS.

The diagnosis of threadworm-disease is far from being such a simple matter as people imagine. Practically, every symptom occurs in, or may be simulated⁴ by, other diseases⁵. And, however strong the presumption may be, the clinical picture is, as a rule, never considered complete⁶, without the one pathognomonic sign—the actual appearance of the worms⁷ or their ova. My own way of diagnosing is simpler : the sufferer is given a few doses of the specific, which cannot do

¹ “ Die Art und Weise, in welcher sie in diese eindringen, ist eine wechselnde und zwar können die Parasiten :

(a) aus dem After in die Scheide selbständig herüber wandern ;

(b) durch Unreinlichkeit nach einer Stuhlentleerung hierher mechanisch verschleppt werden ;

(c) durch Fisteln aus dem einem in das benachbarte Organ gelangen.” (HAUSSMANN, D., *Die Parasiten der weiblichen Geschlechtsorgane des Menschen*, Berlin, 1870, p. 33.)

² “ Beaucoup d’auteurs ont signalé un écoulement leucorrhéique et de véritables vaginites, qui ont résisté à tout traitement et n’ont disparu qu’avec les vers qui les produisaient (observation de David (Gazette médicale, 1843, p. 42) :—jeune fille de 5 ans chez qu’ils avaient produit une leucorrhée intense).” (TERSON, S. E., *op. cit.*, p. 16.)

³ “ On en a vu sortir d’eux-mêmes par l’anus et s’introduire dans le vagin chez les jeunes filles, et y occasionner un prurit in-

supportable.” (TURPIN, V., *op. cit.*, p. 7.)

⁴ The frequent rises of temperature accompanying the presence of worms, particularly in children, may easily be confused with so-called intermittent fever :—“ A medico inexperto facile febris verminosa pro vera febre intermittente typica habetur.” (HINZE, P. E., *op. cit.*, p. 15.)

⁵ “ Interdum epilepsiam mentitur idiopathicam, interdum catalepsin, nonnumquam pleuritidem veram, nonnumquam diarrhoeam et dysenteriam, aliquando febrem quotidianam et quartanam.” (HINZE, P. E., *ibid.*, p. 15.)

⁶ “ Ex omnibus symptomatibus . . . ne unum quidem exstat, quod nos fallere nequeat. Omnium signorum certissimum est sola eorum excretio.” (SCHUEMMER, C., *De morbo verminoso*, Berolini, 1834, p. 17.)

⁷ “ Inter essentialia praecepue, quod est certissimum, referenda est excretio vermium.” (LINDERN, F. B., VON, *Dissertatio Medica de vermibus*, Jenae, 1707, p. 27.)

harm under any circumstances ; and, if the characteristic symptoms disappear, then for all practical purposes the diagnosis is complete, whether the worms have been noticed in the stools or not.

Difficulty of Finding Oxyuris.

For the worms are not by any means easy to detect ; and the fact that they cannot be seen in the stools with the naked eye must not be taken as establishing a definite negative. From their extremely small size, the oxyurides are most difficult to discover, when passed per rectum into the faeces. Moreover, it is their habit, when so passed, to plunge instantly below the surface, provided the faeces are sufficiently soft¹, and thus lose their distinctive colour. Generally a lens must be used in searching for Oxyuris ; while their eggs are so extremely minute, that they are rarely discovered, unless elaborate measures have been taken to isolate them.

Method of Search for Adult Worms.

The adult worms, if present, can be discovered with absolute certainty by a laborious method, described by many helminthologists, who do not disguise the distaste with which they carried it out. The suspected stools are placed on a strainer, made of muslin or soft cloth. If necessary, they may be dealt with in successive portions. Water is then poured over them, and the faeces stirred up with a small stick. All the faecal matter breaks down in this process, and passes through the strainer ; whilst the worms, if any, are left behind.

Method of Search for the Eggs.

To discover eggs, the microscope must always be brought into requisition. A very small portion of faeces is mixed with water on a glass slide, and such preparations are examined successively, with the low power, until the eggs can readily be seen.

Diagnosis from Symptoms.

Failing the discovery of worms or eggs, there is—on orthodox lines—no other certain sign of the disease ; but, as few medical

¹ “ Si les fèces sont liquides, on voit s'agiter avec vivacité les deux extrémités. . . . Souvent on voit qu'il cherche à s'enfoncer dans les matières stercorales.” (FIÉVET, J. C., *op. cit.*, p. 17.)

men, especially if very busy, can take the trouble to make sure whether they are present or not, they are only too often neglected. Even the characteristic itching about the anus and neighbouring parts, which is strong presumptive evidence¹, especially if it comes on at night, is sometimes passed over as irrelevant. And there are a number of other symptoms which should arouse suspicion, and which the sufferer's puzzled medical attendant ascribes to any cause except the right one².

Diagnosis in Children.

This applies, chiefly, when the sufferer is a child, and unable to supply the physician with suggestive information about its sensations. Practically, one may say that whenever a child is in any way abnormal in growth or development, either physical or mental, the possibility of the presence of thread-worms should be suspected. Picking and scratching at the nose, though popularly regarded as strong evidence of "worms," is probably of little diagnostic value, when not accompanied by other symptoms; and the same remark applies to nocturnal enuresis. But restlessness, and grinding of the teeth during sleep are very suspicious; and so, also, is frequent diarrhoea; while "worms" should always be looked for in cases of infantile convulsions, or fits, unless there is some other perfectly obvious cause.

Diagnosis Simplified.

The drastic and dangerous nature of the remedies commonly used justified the demand that absolute certainty of diagnosis should be established, before having recourse to such dangerous drugs as, for instance, *santonin* or *mercury*; and hence, no pains have been spared by authors in their effort to inculcate the highest degree of diagnostic accuracy. But it is obvious that, if a drug can be employed, which is perfectly harmless if no worms are present, and may at the same time be absolutely relied upon to destroy and expel the parasite if it should have

¹ "Sed *Ascaris vermicularis* certa diagnostica signa expromit; in recto et ad anum pruritus molestus excitat." (SCHUEMMER, C., *op. cit.*, pp. 23, 24.)

² "Parmi les symptômes, la

dilatation des pupilles, la teinte bleuâtre des conjonctives et l'aspect picoté de la langue, sont ceux que j'ai le plus souvent remarqués dans les observations que j'ai parcourues." (FIDÉLIN, P., *op. cit.*, p. 36.)

caused the trouble, ocular demonstration of the threadworm, and the unsavoury methods of diagnosis, become relatively of far less importance than heretofore.

X. COMPLICATIONS.

I have included under the term of complications (1) those pathological phenomena which frequently coincide with the presence of the parasite, and, whether they favour¹ the attacks or not, are themselves aggravated by it²; and (2) those morbid states which are definitely caused³ by "worms." Both may persist after the worms have been removed. It is against these complications that mild general measures are needed, to supplement the effects of the drug which expels the Oxyuris.

General Debility and Emaciation.

General debility and emaciation are to some extent symptoms of the disease; but may be so marked and persistent as to become serious complications. The period of debility which, as a rule, follows children's ailments, such as measles, scarlet fever, whooping-cough and chickenpox, renders the subjects very liable to "worms." Children, under their influence, exhibit a condition of retarded development, both physical and mental. Their growth is stunted, and their

¹ In mediæval medicine worms were universally considered the result of disease:—"Quis putaret istum virtutem et mysterium in se tantum continere, contra genus omne vermium ex morbis orientum." (PARACELSUS, T., *op. cit.*, pp. 409, 410.)

² The close connection between intestinal maladies and intestinal worms is insisted upon by many modern observers:—"Dans ces diverses épidémies on a noté le plus souvent la coïncidence de quelque affection intestinale grave qui venait soit compliquer l'élément vermineux, soit plutôt emprunter sa gravité à la complication des vers

. . . et nous verrons qu'on est souvent dans l'embarras pour établir laquelle de ces deux maladies inter-courantes mérite la première place." (RAYNAUD, H. L., *op. cit.*, p. 10.)

³ Threadworms may cause serious mistakes in diagnosis:—"Ils ont causé, même chez des sujets adultes, une foule d'indispositions capable d'en imposer au médecin peu soucieux de rechercher les causes des affections pour lesquelles il est consulté: qu'il me suffise de citer l'urétrite et la dysurie, même chez l'homme." (SANNIER, F. P., *Des principaux entozoaires de l'homme*, Paris, 1869, p. 23.)

intellectual powers remain dull and backward; and their whole appearance and manner present abnormalities, for which the anxious parent can find no explanation.

The debility which accompanies pregnancy is also often aggravated by oxyurides.

Anæmia, Chlorosis, etc.

Definite anæmia may be a complication of this complaint; and so also may chlorosis, or green-sickness¹ in young girls, for whom iron in some form or other is prescribed in unlimited quantities, with no beneficial effects. It is stated that a large proportion of sufferers show changes in the composition of the blood. These usually take the form of an increase in the number of blood-cells known as eosinophils, *i.e.*, those which stain readily with eosin².

Fits and Convulsions.

Fits are common complications of threadworm disease³. In adults they are epileptiform⁴ in character; but children have the typical infantile convulsions⁵, the symptoms of which

¹ Some authors have distinguished a verminous chlorosis:—"Chlorose vermineuse (Beauclair et Viguier); il est probable que dans ce cas la chlorose n'était qu'une cachexie vermineuse." (FIDÉLIN, P., *op. cit.*, p. 32.)

² "The eosinophil cells of the blood are frequently slightly increased in number—Dr. Boycott states that in about two-fifths of his cases in children who harboured *Oxyuris* a definite increase in the eosinophils had occurred; more rarely a high grade of eosinophilia (up to 16 per cent.) is set up, whilst quite commonly the blood shows normal proportions." (MANSON, P., and SHIPLEY, A. E., *Parasitic Worms*, in ALLBUTT'S *System of Medicine*, London, 1907, vol. ii., part ii., p. 892.)

³ WEIST quotes a remarkable case of epileptic fits in a little girl, which were solely due to worms, and disappeared with the latter:—

"Prima aegrota in praxi mea erat puella annis decem, quae indies laborat tricies Epilepsia, quae horribilibus actionibus exercitabatur, cursitabat per pagum delirans, clamabat, circumjiciebatur, cum vero centum Vermes ab eadem evacuaverim, restituta fait et bene adhuc valet ad hunc usque diem." (WEIST, D. S., *op. cit.*, p. 9.)

⁴ "Bartholin et Stahl ont observé chacun un cas d'épilepsie entretenue par des oxyures." (FIDÉLIN, P., *op. cit.*, p. 29.)

⁵ These convulsions are, at times, so serious as to end in death:—"Ces convulsions sont . . . plus fréquentes dans la première enfance que dans l'âge adulte: cependant on les a rencontrées entre 18 mois et 45 ans. La mort a eu lieu à peu près un nombre égal de fois dans les convulsions accompagnant d'autres maladies, et dans les convulsions simples." (FIDÉLIN, P., *ibid.*, p. 14.)

are so extremely alarming. Medical advice is summoned, the child is drugged, after a rough and ready diagnosis ; but, in nine out of ten cases, the fact is overlooked that “ worms ” are the principal cause of fits.

Pulmonary Consumption and Tuberculosis.

It is well-known that pulmonary consumption, and other tuberculous diseases, frequently co-exist with threadworms, and intensify their evil results. In some cases, doubtless, the tuberculous condition, with its consequent debility, may be a predisposing cause of the parasitic invasion ; but, not improbably, this sequence of events may, particularly in the case of children, often be reversed ; and thus threadworm disease ultimately leads to general tuberculous infection and premature death.

Local Complications.

Locally, the irritation of the worms may cause piles, or haemorrhoids, especially in children ; and prolapsus ani, or falling of the bowel, may be another result of the disease. The skin of the perinaeum, when affected with pruritis ani, forms a particularly favourable soil for the development of other skin diseases. Eczema, therefore, often supervenes, usually of the moist variety.

Mucous colitis may be either a complication or a predisposing cause, as any excess of mucus¹ in the intestine is undoubtedly favourable to the Oxyuris.

Complications due to Wandering.

Though usually found only in the ileum, cœcum, colon and rectum, it is an accepted fact that threadworms occasionally wander from their usual haunts to other parts of the body², and give rise to a variety of complications ; among which may be mentioned :—jaundice, chronic appendicitis and periappendicitis, verminous tubercles³, peri-rectal abscesses,

¹ “ Nulla vermium frequentior habita est causa, quam mucus intestina oblinens.” (PALMER, J. F., *op. cit.*, p. 4.)

² “ Brèra en a vu dans l’oesophage une quantité innombrable, Bianchi prétend en avoir vu dans les ventricules du cerveau.” (TUPIN, V., *op. cit.*, p. 7.)

³ “ The *Oxyuris* may traverse the intestinal wall, and has been found in the peritoneal cavity, where they may form verminous tubercles in Douglas’s fossa, or peri-rectal abscesses.” (OSLER, W., *The Principles and Practice of Medicine*, New York and London, 1909, p. 39.)

urethritis¹, vulvitis, vaginitis²—accompanied by leucorrhoea—amenorrhoea, satyriasis³ or nymphomania⁴, and the resulting vicious⁵ habits⁶. The case of a child is on record, in which a number of threadworms were passed in the urine⁷, after

¹ “Nymphomanie.—Les oxyures vermiculaires ont souvent déterminé la nymphomanie: leur présence dans le rectum suffrait pour l'expliquer, mais de plus, il leur arrive parfois de se porter à l'extérieur, pour de là remonter, chez la femme dans le vagin, et même dans l'urètre et dans la vessie.” (FIDÉLIN, P., *op. cit.*, p. 30.)

² “Dass kleinen Mädchen Oxyuren aus dem After in die Scheide kriechen, ist eine schon den ältesten Aerzten bekannte Thatsache.” (KUECHENMEISTER, G. F. A., *op. cit.*, vol. i., p. 229.)

³ “Chez l'homme, j'ai rencontré un priapisme produit par des oxyures: un berger, âgé de 62 ans, éprouvait toutes les nuits des érections qui commençaient par un chatouillement à l'anus; j'examinai le malade et je trouvai des oxyures en grand nombre autour de l'anus.” (FIDÉLIN, P., *op. cit.*, p. 31.)

⁴ “Bremser, Scharf et Becker rapportent des exemples où une véritable nymphomanie s'était déclarée chez des femmes âgées par la présence d'oxyures dans le vagin.” (TURPIN, V., *op. cit.*, p. 15.)

⁵ “Les organes génitaux deviennent la siège d'un certain degré d'excitation, par suite de laquelle il n'est pas rare de voir les jeunes gens s'abandonner à la masturbation et tomber dans le satyriasis; chez les femmes on observe quelquefois la suppression des menstrues; chez elles encore, l'introduction de vers dans les parties génitales peut occasioner la nymphomanie, ainsi que l'excoriation et même l'ulcération de ces parties.” (COLIN, P. D., *op. cit.*, p. 13.)

⁶ “Dass die Madenwürmer eine gewisse Zeit hindurch in den Geschlechtsorganen ihre Lebensfähigkeit

behalten, beweist die von allen Beobachtern, so neuerdings von P. M. Guersant angegebene intensive Reizung, welche durch die Bewegung der Parasiten entsteht und sich durch Röthung, Schwellung der Schleimhaut und heftiges bis zur Masturbation führendes Jucken kund giebt.” (HAUSSMANN, D., *op. cit.*, p. 40.)

⁷ KUEHN gives the following circumstantial account of the case:—“Filius mercatoris R. . . . Isenacensis, natus annos sex, cum maximo corporis vigore uteretur, repente, hora VI. vespertina coenans, in tetanum verum incidit. Pater meus accersitur, mihi una eundi et videndi potestatem facit. Remediis antispasmodicis, quae praeceperat pater in spina dorsi et ventre inunctis, adjunctaque fritione, symptomata quidem spasmi se remiserant, sed paullo post in profundum somnum et sudorem puer incidit sex horarum spatio durantem. Exporrectus somno matulam petit, et, interjecto subinde vagitu, multam urinae copiam emittit, in qua ascarides vermiculares ultra quam ducentae visebantur, plurimae aliquamdiu superstites erant. Urina ipsa, quod maxime memoratu dignum est, naturalis, clara, sine pituita et glarea erat. Puer deinde sumsit laxans ex mercurio dulci et pulvere Jalappae. Alvus nullum vestigium vermium prae se ferebat. Inde convaluit, et firma valetudine usus est. Antea nulli affectioni obnoxius fuerat, ex qua aliquis vermes conicere potuisset, nisi quod interdum exanthemata in cute pullulaverant. Neque ante observatum est vermes per alvum ejcetos fuisse, multo minus per urinam.” (KUEHN, J. A. C., *De Ascaridibus per urinam emissis*, Jenae, 1798, pp. 12, 13.)

having caused terrifying convulsions ; and another in which their presence in the stomach caused cardialgia¹.

Neurasthenia, Hysteria, and Insanity.

Several authorities have stated that they have seen cases of insanity², usually maniacal or melancholic³ caused by these parasites ; while I have, myself, observed several instances of hysteria⁴ and neurasthenia, in which threadworms had undoubtedly been one of the aetiological factors.

XI. DANGERS AND DEFECTS OF RECOGNISED TREATMENTS.

All recognised modes of treatment may be divided into two great groups :—

(1) Drastic treatment with purgatives or anthelmintic drugs, administered per os, per rectum, or by both ;

(2) Expectant, or hygienic treatment, without anthelmintic drugs.

¹ “ Sauvages de cardialgia mentionem fecit, quae in oppido quodam plures e medio sustulerit, e quibus, secto cadavere, invenit vermes ventriculi tunicis adeo adhaerentes ut vel perforassent.” (PALMER, J. F., *op. cit.*, pp. 26, 27.)

² “ Le séjour des vers dans l'économie peut quelquefois déterminer la folie. M. Esquirol a été témoin de plusieurs guérisons survenues tout à coup après l'expulsion des entozoaires. D'après cet auteur, sur sept cent trente cas, vingt-huit folies ne reconnaissent pas d'autres causes. Prost, van Swieten rapportent des observations semblables, et dans le Dictionnaire en trente volumes, Georget admet des folies vermineuses. Une observation a été publiée par M. Esquirol, en 1832 dans son mémoire lu à

l'Institut. Il s'agissait d'un étudiant en médecine, de vingt ans, pris tout à coup de manie, qui céda après l'expulsion de lombrics et d'oxyures.” (FIDÉLIN, P., *op. cit.*, p. 24.)

³ “ Giraudy parle d'un jeune homme de 16 ans, atteint de mélancolie, guéri après plusieurs évacuations d'ascarides vermiculaires.” (PASQUIOU, F. M., *Des helminthes vivant dans le tube digestif*, Paris, 1865, p. 23.)

⁴ FIDÉLIN has observed a similar case in a little girl of 9 :—“ Un cas d'hystérie grave, ayant persisté plus d'un an, chez une jeune fille de 9 ans : guérison par l'évacuation d'un nombre immense d'ascarides lombricoides et d'oxyures.” (FIDÉLIN, P., *op. cit.*, p. 32.)

Local Appliances.

Both methods of treatment may be supplemented by local appliances¹ of a purely palliative nature, for relieving the irritation about the anus; for this purpose, various preparations are used, of which fatty substances are generally the basis, such as mercurial, cocaine, or belladonna, ointments². No curative action is claimed for any of these. It is, on the other hand, well known that the ointments may affect the sensitive skins of children.

The Multitude of Anthelmintic Drugs.

The drastic treatment³ is carried out by means of anthelmintic drugs, introduced per os, or per rectum; and the unsatisfactory results⁴ of the therapeutics of threadworm

¹ The use of powdered worms as a local application is mentioned by STEENEVELT:—"Vermes desiccatos et in pulverem redactos, contra praedictum morbum commendant plurimi." (STEENEVELT, C., *Dissertatio de ulcere verminoso*, Lugduni Batavor., 1698, p. 22.)

² One of the oldest and quaintest local appliances is the use of a piece of fat bacon as a kind of bait:—"On a aussi introduit utilement dans le rectum un morceau de lard frais, auquel viennent se fixer les oxyures." (HÉMONT, G. M., *op. cit.*, p. 35.)

³ Even ANDRY, who, for his time, was singularly well-informed on this subject, recognises the inefficacy of drastic treatment:—"Les Ascarides sont des vers difficiles à chasser, et cela pour plusieurs raisons. La première, c'est que ces animaux sont fort éloignés du ventricule, en sorte que les remèdes perdent leur force avant que de parvenir jusqu'où sont les vers. La seconde, c'est que les ascarides sont enveloppés dans les humeurs visqueuses, qui empêchent l'action des médicaments. La troisième, c'est que ces vers montent quelquefois dans le cæcum; or, cet intestin étant en forme de cul de sac, les ascarides s'y tiennent comme retranchés." (ANDRY, N.,

de la generation des vers dans le corps de l'homme, Paris, 1700, p. 248.)

⁴ COULET relates that the failure of a physician to cure a friend of his who had been suffering from threadworms, induced him to take up the study of medicine himself, in the hope (unfortunately not realised) of finding a cure:—"Amicus meus . . . se gravissimo certe morbo laborare putabat, et ut apud Medicam comitem me habere rogabat. Pauca dixit Medicus, praeterquamquod Vermiculi illi (quod ipse, audita descriptione, *ascarides* nominavit), non multum pericelli secum adferabant, modo tempestive causae eos producenti obviam iretur. Praescripsit pulverem quemdam semel de die ad quantitatem dragmae unius, mane et jejuno ventriculo sumendum, vel ex vino, vel ex cerevisia; huic pulveri addidit clysmata attero quoque die sub vesperi injiciendum. Quae autem medicamenta, vel pulverem, vel clysmata ingraderentur, memoria mea exciderunt, unum scio, scilicet, quod Amico meo dixerit, utrumque ex amarissimis remediis fuisse confectum, quorum virtuti tenacissima Vermium quorumcunque maleries cedare cogeretur.

"Quid accidit? Amicus meus pulvere et clysmate usus est, et

disease is amply¹ demonstrated², if such proof be necessary³, by the enormous number of agents which have been used and recommended. Practically one-half of all drugs which are, or ever have been, in any pharmacopœia, have at some time enjoyed a reputation⁴ for threadworms. But not one has stood the test of experience, and nearly all are now thoroughly discredited; though some members of the medical profession still profess to pin their faith to a few of them.

Vermifuges and Vermicides.

The orthodox pharmacologies usually divide anthelmintics into two groups, viz. :—*Vermifuges*, those which are credited with the power of expelling the parasites; *Vermicides*, or agents which are believed to actually kill the worms. It is

quidem per plures septimanas: et per totum hoc tempus, aliquando in dejectionibus plures, aliquando nullos ascarides videbat. Remediis uti cessavit, et eadem atque antea Phaenomena apparebant; hoc est per aliquot dies aliquos, et per plures nullos Ascarides reddebat. Per totum fere annum hoc sic durabit, et postea cos multo rarius reddidit, sed sumper plures dies quam antea, eorum ejectis durabat, postquam inceperat.

“Tandem, postquam instabilis vitae pertaesus, Medicinae studio sedulo me applicare mihi proposuissem, atque ab amici mei morbo, qui in eadum prorsus conditione, neque meliore, neque pegore erat, initium facere; ille mihi quidquid penes ipsum erat libenter ad hunc finem suppeditavit.” (COULET, S., *Tractatus historicus de ascaridibus et lumbrico lato*, Lugd. Batavorum, 1729, p. 13.)

¹ KUECHENMEISTER is equally pessimistic in prognosis of thread-worm-disease :—“Die Prognose ist ungünstig, da das Leiden zwar gebessert, nur sehr schwer aber und selbst nicht durchs Alter beseitigt wird.” (KUECHENMEISTER, G. F. A., *op. cit.*, vol. i., p. 288.)

² COBBOLD, in 1864 and after, fully agreed with his predecessors :—

“Of all the parasites infesting the human body, this is the one concerning which the medical practitioners are most frequently consulted . . . more particularly on account of the extreme difficulty experienced in getting permanently rid of it.” (COBBOLD, T. S., *Entozoa, an introduction to the study of Helminthology*, London, 1864, p. 363.)

³ It will be seen that Professors MOSLER and PEIPER, both of the Greifswald medical faculty, whose book was published in 1894, had therapeutically not advanced a whit beyond ANDRY, COULET, and KUECHENMEISTER :—“Soll dauernde Heilung erzielt werden, so muss die Kur häufig Wochen hindurch fortgesetzt werden, um sämtliche im Darne vorhandenen Parasiten zu beseitigen.” (MOSLER, F. and PEIPER, E., *op. cit.*, p. 236.)

⁴ Special treatment.—“Ascarides vermiculares pruritus ani, vel et genitalium saepe intolerabilem efficiunt, vix nisi clysmatibus et injectionibus, his vero repetitis satis facile abiguntur. Blanda ex decocto hordeaceo, aqua, melle, oleo vel sale addito seligantur; acria vel tabacina nociva sunt. Si injectiones non sufficiunt, purgans simul propinatur.” (RUDOLPH, C. A., *op. cit.*, vol. i., pp. 510, 511.)

obviously by no means easy to draw a broad line of demarcation between these two divisions, except in so far as the first group comprises most purgative drugs. Many drugs were believed to act both as vermifuges and vermicides; whilst, in the case of others, those who recommend them do not know, or, wisely, do not care to explain, in what manner the drugs which they favour produce the desired effect¹.

Mineral Purgatives as Anthelmintics.

Foremost among Vermifuges rank the "saline" purgatives; and the drugs commonly prescribed for *Oxyuris* are the more drastic members of this class, such as the alkaline carbonates (sodium, potassium and ammonium), the oxide and carbonate of magnesium, the sulphates of sodium, potassium and magnesium, and the bi-tartrate of potassium. These substances are said to act by increasing the flow of fluid from the glands of the intestinal walls; and, though they are useful aperients, there is no good ground for crediting them with any special action upon threadworms, which, indeed, they commonly fail even to expel.

Other mineral substances which enjoy a reputation as anthelmintics are sulphur, and calomel, to which specific virtues have been ascribed, in addition to their purgative action. But sulphur, especially in large doses, is by no means harmless, and often causes headaches and nervous depression. On the other hand, calomel, or subchloride of mercury, by increasing the flow of bile becomes a powerful purgative, but it frequently sets up symptoms of poisoning, and its use, particularly in the case of children or other weak subjects²,

¹ PARACELSUS recommends dried and powdered worms taken in goats' milk!—" . . . verum alios vermes omnes in hominibus ortum et sustentationem habentes, quocunque nomine vocentur, ubi siccati fuerint, pulverati, necnon hominibus intrinsecus administrati cum quovis liquore: in caprino lacte melius: vermes omnes ad hunc modum expellunt ab intestinis et stomacho per secessum." (PARACELSUS, T., *op. cit.*, p. 412.)

² The danger of mercurial vermicides has long been recognised:—"Ad mercurialia, tamquam sacram anchoram, confugiunt practici, quae certe, in siccioribus, quibus humorum tenuitas et acrimonia molestiam creant, minime vermes necant, sed universum corpus, attenuando, magis humores subducunt, atque ita emaciant, ut omnes ejus functiones pessundentur." (VAGHI, G., *De insectorum in corpore humano genitorum varia forma et indole*, Vitembergae, 1741, pp. 73, 74.)

cannot be too strongly condemned. In addition, it may be said, once for all, that neither sulphur nor calomel is really specific for threadworms ; and their fame in this respect is a survival of the times when these popular drugs were in turn lauded as specific for nearly every ill which human flesh is heir to.

Vegetable Purgatives as Anthelmintics.

Senna, rhubarb and castor-oil are comparatively mild purgatives, which are generally regarded as safe. All of them, however, may cause severe griping pain, or even colic ; and though they appear to clear out the intestine, they are very ineffectual in removing from the cœcum the threadworms, upon which they certainly exert no specific action.

Aloes, jalap, podophyllin and scammony, the most popular of vegetable purgatives, are all powerful irritants, and must not be used if the alimentary canal is at all inflamed, as it usually is in the subject of "worms." Aloes, in addition, has a stimulating action on the uterus, and may cause abortion. None of these has any true effect on the parasite.

Colocynth, gratiola, and *Brayera Anthelmintica* are drastic hydragogue cathartics, causing profuse watery diarrhœa ; and, often, such symptoms of poisoning as nausea, vomiting and colic ; and their use may thus set up acute danger. Any specific vermifugal action they may possess applies to tapeworm only.

Elaterium and gamboge are still more violent and dangerous members of the same class ; whilst croton oil, the strongest purgative known, is a virulent poison, so powerful that it will, even if applied to the outer skin, often cause ulceration.

Proprietary "Mineral" Waters as Anthelmintics.

Other remedies include the natural mineral waters, such as Apenta, Pullna, Hunyadi János, Friedrichshall, etc. These are simply solutions of various mineral salts, upon which their purgative action depends, and the latter is described above. Though these waters have found many supporters amongst medical men, they can have very little effect on "worms," seeing that even their promoters make no such claim.

Purgative Enemas.

Whilst almost any fluid administered as an enema excites peristalsis, and so causes purgation, certain agents with a definite purgative action are sometimes given in this way, as a treatment for worms. Such are soap, common salt, sugar-and-water, glycerine, sulphur-water and aloes ; and they will be dealt with under the heading "Rectal Treatment."

Anthelmintics Proper or Vermicides.

This group includes all medicinal agents which are believed to kill the "worms." Nearly all are of vegetable origin¹, none are reliable as regards *Oxyuris*, and few are free from danger.

Ineffective Vermicides.

A number of agents, which have been recommended as vermicides, appear to have very little, if any, action upon any worms ; and in this category may be reckoned raw onions and garlic ; bitters, such as husks of walnuts, which were recommended by Hippocrates, ox-bile, quassia and cascarilla ; Calamintha, Dippel's Oel, Flores (sic) Verbasci (Kuechenmeister), and Ghatti gummi. Others, of which *Chenopodium*, *Butea Frondosa*, wormseed and wormwood are only a few representatives, destroy *Ascaris lumbricoides*, but not *Oxyuris*. While powdered tin, *Filix mas*, *Granati Radix*, *Couso*, *Brayera Anthelmintica*, *Musenna*, and many other drugs, act only on the tapeworm.

¹ J. SCHAEFFER, in *Dissertatio inauguralis medica sistens Anthelmintica Regni Vegetabilis*, Altdorf, 1784, reviews the vegetable anthelmintics which enjoyed a reputation in his day, or had done so previously. He gives a complete list of them, occupying 85 pages, including an appendix, and divides them into 24 Classes (Botanical). The information he gives on each drug is fully representative of the state of knowledge at that time ; but there are very few which he himself is able to recommend as anthelmintics. His list includes a number of plants which do not now figure in any pharmacopœia, but amongst those which are still used (some

only occasionally) as anthelmintics may be mentioned : Ginger, cardamon, oleum olivae, gratiola, verbenä, piper nigrum, cubebs, valerian, saccharum, triticum repens, spigelia, scammony, jalap, cinchona, coffee, tobacco, capsicum, nux vomica, gentian, coriander, carum carui, sambucus, scilla, aloes, cinnamon, camphor, rhubarb, ruta, quassia, euphorbia, amygdalus, caryophyllum, papaver somniferum (opium), gamboge, staphisagria, acornite, helleborus, mentha piperita, sinapis, glycyrrhiza, orange, santonica, anthemis, serpentaria, pinus sylvestris, croton tiglium, ricinus, colocynth, cannabis indica, savin, veratrum, filix mas, myrrha.

Dangerous Vermicides.

The use of many so-called Vermicides entails grave risks, from the dangerous or poisonous properties they possess. Thus perchloride of iron is a powerful astringent, sulphuric ether a narcotic, naphthaline and corrosive sublimate dangerous irritant poisons. All these are given in enemata. Cowhage, or mucuna (also known as *Stizolobium* and *Dolichos Pruriens*), is extremely irritant; turpentine, which is also an important ingredient of *Oleum Chaberti*, once a popular anthelmintic, is a dangerous poison, affecting particularly the brain and kidneys; and *Spigelia* in large doses is a narcotic poison. *Couso*, *Brayera Anthelmintica*, and *Andira* are all irritants. *Tansy* is irritant, narcotic and emmenagogue; *Valerian* (*Baldrian*) is a nerve depressant; and *Veratrum* a powerful irritant poison; whilst *Geoffroya Inermis* causes vomiting, fever and delirium. *Santonica* and *Santonine*, the most popular vermicides, are dealt with below.

The Most Popular Anthelmintic—Santonine.

By far the most generally used vermicide is *Santonine*, which is, indeed, with many practitioners, the routine treatment. *Santonine* is a white, crystalline powder, containing the active principle of the flowers of *Artemisia Santonica*, formerly known as *Semen contra vermes*. It is usual to give small doses—from $\frac{1}{4}$ to 2 grains—of the drug, either alone, or, more often, combined with a purgative powder, such as calomel, jalap, or the compound rhubarb powder; and the dose is repeated as often as may be considered necessary. It is also occasionally given in an enema.

The Dangers of Santonine.

Santonine, however, is very far from being reliable in its action on Oxyuris. It frequently entirely fails to destroy the threadworms; while its effect on the patient may be extremely disagreeable, or, particularly in the case of children, even dangerous. It is, in fact, recognised as a powerful poison, the symptoms of *Santonine* poisoning being—chromatopsia, or coloured vision, first blue, then yellow, ending in total loss of colour-vision; green or deep yellow colour of the urine; disturbances of consciousness, cold surface, aphasia,

tremors, convulsions, and finally death. Two grains are said to have proved fatal to a child of five.

Rectal Treatment.

A great and varied number of agents have been administered by the rectum¹ in the attempt to destroy, or drive out, thread-worms, some of which have already been mentioned. The most popular are ice-cold water (as used by Van Swieten), lime-water, salt-and-water, infusion of quassia, turpentine, and solution of perchloride of iron, as vermicides, and warm water, soap-and-water, sugar-and-water, Epsom salts, oil, and glycerine, as vermifuges.

Among the less common remedies, mention may be made of tobacco smoke ; and also of ether, naphthaline and corrosive sublimate.

Every kind of rectal treatment is open to serious objection. It is more than doubtful if substances injected in enemas ever reach as high as the cœcum, and, if given in suppositories, they certainly do not ; while their administration is apt to cause pain, griping, tenesmus, and, frequently, diarrhœa. But, apart from these immediate effects, due to the drugs used, the repeated use of enemas of any kind must have a tendency to relax the rectal walls, and so cause piles, and to weaken and distend the sphincter muscle, thus leading to *prolapsus ani*, which occurs on very slight provocation in weakly children. Moreover, there is always a risk, when powerful drugs are used in this way, of absorption taking place, and producing symptoms of constitutional poisoning.

Expectant, or Hygienic, Treatment.

Of all orthodox methods of treatment the expectant, or

¹ KUECHENMEISTER admits that only drastic enemata, which reach beyond the sigmoid flexure can be trusted :—" Heilung kann man nur durch lange fortgesetzte allabendliche Lavements erreichen, und in einigermaassen hartnäckigen Fällen auch dann nur, wenn man sich hierbei der neuerdings, besonders von Griesinger empfohlenen elastischen Ansatzrohre oder Katheter bedient, die bis über die Flexura

sigmoidea hinauf eingeführt werden. Auf diese Weise gelangt der Strom des Lavements, was eine Hauptsache ist, auch zu den über der Flexura sigmoidea befindlichen Oxyuren. Leider entgeht der Einwirkung des Klystieres auch immer noch eine grosse Anzahl jener Wurmem Exemplare, die sich hinter den Mastdarmfalten verbergen und verhalten." (KUECHENMEISTER, G. F. A., *op. cit.*, vol. i., p. 289.)

hygienic, is least open to objection, since it does nothing which can injure the patient, as do some of the drugs already referred to. It consists in endeavouring to support, and maintain, the patient's strength, until nature has worked a cure. With this view an appropriate diet is ordered, and tonic medicines are given, whilst most scrupulous care is taken to prevent re-infection. And if, by means of perfect cleanliness and hygienic conditions, re-infection can be absolutely prevented, so that no more ova are swallowed, the existing generation of parasites dies out, and the patient is freed from his trouble, without taking anthelmintic drugs.

Drawbacks of Expectant Treatment.

As can easily be seen, such expectant treatment is a very lengthy process ; and it is not difficult to understand why it is rarely resorted to. Indeed, it calls for a good deal of moral courage on the part of the medical adviser ; for few patients are content simply to stand by, and let nature and time cure the disease. Moreover, the necessary absolute cleanliness is often difficult to enforce, especially in children ; and a single lapse may, and probably will, entail a repetition of the whole wearisome process.

XII. THE SIMPLIFIED TREATMENT, AND A FEW TYPICAL CASES.

I have already briefly described my method of treatment at the beginning of this book, but a certain amount of repetition may be needed to make it perfectly clear. My first object in dealing with this extremely prevalent helminthiasis is to destroy the parasite. This I achieve by means of a highly diluted tincture, which I have found to be a true specific against *Oxyuris Vermicularis*.

Effect of Drug on *Oxyuris Vermicularis*.

The first effect of the drug is to relieve the troublesome symptoms, particularly the uneasiness in the bowels, and the irritation about the anus. Next, dead threadworms are to be

seen in the stools. In many cases where no threadworms had been suspected, it has been reported to me that hundreds and hundreds made their appearance in this way. A short time later no more are seen, all the worms having evidently been destroyed and expelled ; and, provided no re-infection takes place, which a little care will ensure, the sufferer is freed from the invaders.

If, nevertheless, re-infection does occur, and is detected early, the effect of the drug is even more rapid, a few hours being, as a rule, sufficient to clear out the new generation of worms. Re-infection, therefore, presents no terrors when this treatment is employed.

Effect on Worms other than *Oxyuris*.

The tincture destroys other intestinal parasites besides *Oxyuris*, especially the smaller kinds. Several patients have reported, that after taking it, they passed other worms as well as threadworms, the species identified being *Ascaris Lumbricoides* and *Tricocephalus Dispar*. The latter, however, is far from common in this country ; and though the former is met with more frequently, it usually yields to treatment so readily as to present no difficulties to the practitioner. Consequently, I have so far made no special observations on the effect of this drug upon the above parasites, and do not claim that it is a specific for either of them. I am not aware whether it has any effect upon tapeworms.

Mode of Action.

It will naturally be asked : how does the drug act ? I believe the explanation to be that the minute doses of the tincture given suffice to alter the composition of the digestive juices in such a way, as to make them poisonous for the minute *Oxyurides*. Their environment is no longer congenial, and they flee from it ; or, if they fail to do so, they perish. The situation may be aptly compared with the condition of things, which exists when poisonous gases escape into a coal mine. The miners endeavour to escape from the dangerous atmosphere ; and if they cannot succeed in doing so, they are asphyxiated. Incidentally, the action of this drug affords incontrovertible, I should say almost ocular, evidence of the

efficacy of the small doses, which constitute one of the main principles of Homœopathy. In the light of such striking results the possibility of very minute quantities of a drug producing marked physiological effects on living tissue becomes a scientific fact.

The Specific—and after.

The tincture never fails to destroy, or expel, the threadworms. But it must not be imagined that I regard this effect alone as constituting a complete “cure” of the patient, whether the latter be child or adult. My aims in treatment are more ambitious. Every medical man will agree that drugs possessing specific properties can do no more than relieve or remove specific symptoms, and the presence of worms is only a symptom, if the word be taken in its widest sense. But even specific drugs cannot possibly, by themselves, recall the entire organism of the sufferer to the smooth path of healthy evolution, from which it has more or less strayed. This must be the ultimate object of all curative treatment; and until this has been achieved, the physician is not entitled to consider his patient cured.

Constitutional Treatment, where no other Malady Exists.

I have already indicated that the constitutional conditions which predispose to, or complicate, threadworm disease sometimes take the form of such definite maladies as tuberculosis, Bright’s disease, diabetes, and the like. Now it is obviously impossible even to outline, far less to describe in detail in such a work as this, the methods of treatment I adopt in complicated cases of this kind. A full account must be reserved for another place. Such treatment as I outline below is intended to correct the conditions of debility, commonly spoken of as functional, which co-exist without exception with threadworm disease, but cannot themselves be described as distinct diseases. The symptoms of such general debility are familiar to every one, and include pallor, anæmia, indigestion, loss of appetite, sleeplessness or disturbed sleep, disinclination for effort, rapid exhaustion, palpitation, nervousness, retarded physical or mental development in the case of children, etc.

General Principles of Treatment.

It must have become evident from what has gone before that I combine in my treatment, no matter what the complaint, palliative measures with curative or constitutional methods. I do not content myself with relieving symptoms, without paying any attention to underlying causes ; and on the other hand, I do not believe in methods of procrastination, which ignore urgent symptoms and trust that the *Vis medicatrix naturae*, once aroused, will ultimately reach them.

But whether employing palliatives, such as, for instance, the tincture for the threadworm, or directing constitutional treatment, I most scrupulously avoid all therapeutic agents from which the slightest harm could be anticipated. And I base this principle on my conception of the human body as the most delicate and the most sensitive piece of mechanism imaginable, and liable to be permanently injured by careless or rough handling. I, therefore, hold all drastic measures to be, generally speaking, inadmissible, whether the patient be child or adult. The very rare occasions when a medical man is really justified in taking risks do not come within the scope of this work.

Diet and Regime.

The diet is changed as little as possible. Only those food-stuffs should be forbidden which are found by experience to cause symptoms of indigestion, such as flatulence, heartburn, and the like. The consumption of alcoholic liquors is reduced to a minimum. Apart from this, no restrictions are necessary. I do not believe in hampering the patient by meaningless, and often faddy, rules and regulations. It is a frequent experience of mine to be consulted by patients upon whom a regime equivalent to slow starvation had been previously imposed quite unnecessarily. In particular, there is no object in depriving children of green vegetables (for fear they may convey fresh infection), since the tincture provides so simple a means of getting rid of any fresh worms which may develop. In the earlier stages of the "cure," plenty of rest is advisable.

Medicines.

In general treatment for the debility met with concurrently with threadworm disease, I employ the simple homœopathic

remedies which, in minute doses, I have proved to be most efficacious in correcting divers abnormalities of function. Such drugs are :—*Acid. Phosph.*, *Acon.*, *Bryonia*, *Calc. Carb.*, *Carbo Veg.*, *Coffea*, *Ferr. Mur.*, *Graphites*, *Ignatia Amara*, *Nux Vom.*, *Silicea*, *Thuja Occ.*, and others. All these are perfectly harmless in the highly attenuated form in which they are given, and I have found it no little satisfaction to patients and their relatives to know beforehand, that if the drugs should fail to do any apparent good, they certainly could not, in any case, do any injury.

Baths, and other Hydropathic Measures.

In employing approved hydropathic measures, mildness and gentleness are again the all-important considerations. The baths are carefully regulated, and any excess of heat or cold is discouraged. Medicated baths are often employed with advantage, and I have obtained excellent and undoubted results from a series of damp compresses, which I order to be applied in turn to various parts of the body.

Massage.

In many cases of debility, gentle massage is a useful adjunct, but here again experience has proved that violent manipulations are apt to be followed by dangerous reactions, and that this physical agent will produce most admirable results only if quietly and patiently evoked.

Physical Exercises.

The physical exercises which I am in the habit of ordering are of the gentlest possible nature, and, in the main, reserved until a fairly advanced stage of the treatment, when all the other measures have had time to restore the body to a normal state. I rigorously exclude vigorous exercises at all times ; no dumb-bells or developers must be used. Muscular development, acquired at the expense of other functions of the body, never fails to impair either the nervous or the vascular system, or both. The hypertrophied heart and the nervous breakdown of the athlete, so well known to medical men, are dangers not to be trifled with.

Case of a little Girl of 5½ years.

HISTORY :—This is best set forth by the following letter, received from the patient's father :—

“ I have been recommended by Mrs. . . . to write to you respecting my daughter, aged 5½ years. She has been suffering for some time past with worms. They appear to be like little white threads of cotton, in the motion. I have taken her to two local doctors, who have told me to give her Syrup of Figs, and use a syringe, which I have done for some time. This, however, appears to do good for a short time only ; and it really seems to make her so very weak. One doctor said she has them in her chest. She is always at her nose, and grinds her teeth very much at night, when asleep ; and gets so very pale.

“ She suffers at times with a cough. This appears to get worse at times, and if I give her a worm-powder, which I have obtained from the chemist, it appears to relieve the cough for a time. . . .

“ I should feel grateful if you would tell me what I could do to relieve, or cure, my child of this complaint, which, I feel sure, is most distressing to her.”

EXAMINATION, Dec. 16th :—Everything stated in the above letter was confirmed. The child appeared very shy, irritable at times, extremely nervous, and depressed. She complained of occasional headaches. She was well-nourished, but not fat. Height, 3 feet 7 inches. Her complexion was clear, but markedly pale ; in fact, she was anæmic. Her eyes were dull, and sunken, and surrounded by dark rings. On the whole, she presented, in a striking degree, the aspect of a sufferer from tuberculosis. The vulva and vagina were inflamed, and showed slight leucorrhœa ; and there was evidence that the habit of self-abuse had been contracted.

One uncle and one aunt were stated to have died of phthisis.

TREATMENT :—At first, only palliative treatment was resorted to. She was ordered three drops of the tincture, three times a day, before meals.

PROGRESS :—This is indicated by a letter from the father, dated Dec. 20th, *i.e.*, 4 days after the treatment commenced :—

“ I am writing you, as you requested, to report upon the

result of your treatment of my daughter. I am pleased to say, in every respect, it seems satisfactory.

“On Thursday night last she had one dose of medicine, and on Friday morning another dose. She then had the use of her bowels, and her mother examined the matter, and found several worms, quite dead, one or two of them quite $1\frac{1}{2}$ inches long. I saw them myself. They were about the thickness of *very* thin twine. Each day has brought the same result.

“On Saturday morning there were quite a lot of small ones ; but on Sunday there were fewer.

“This (Monday) morning none could be found. She says she cannot feel anything now like she used to in the stomach. Her eyes seem brighter, the rings have disappeared from beneath them, and her skin to-day has taken on a decidedly healthier tinge; and she says she feels so much better. She has not been at her nose at all, neither does she grind her teeth when asleep ; and she certainly sleeps the night through, with hardly a movement. Where before she hardly cared whether she had anything to eat or not, she now appears to enjoy her food.

“This is all I can think of now.

“I should be pleased to bring her to see you, if you would now be so kind as to prescribe also a course of constitutional treatment for her.”

Jan. 3rd.—The child was seen again, and everything in the above letter was confirmed. Weight, 3 stone 1 lb. 6 oz. A mild course of constitutional treatment for the after-effects was commenced.

Jan. 17th.—Seen again. Weight, 3 stone 2 lb. 10 oz.

Jan. 31st.—Seen again. The child was now entirely changed, and looked absolutely healthy. It was, however, clear that re-infection had occurred, as, during the interval since her last visit, one or two threadworms had been noticed in the stools. The doses of the tincture had, therefore, been repeated for one day, when three more dead worms appeared. No more were seen after this.

Feb. 14th.—It was reported to me that the inflammation of the vulva and vagina had disappeared ; and that the child seemed perfectly healthy in every way.

Case of a little Boy aged 9.

HISTORY:—This was a little boy, of 9, whose family had formerly resided in India, but had returned to England, and were living in a provincial town. The patient, his parents, and his brothers and sisters, had all had malarial fever and still suffered from the after-effects, the father and mother complaining of sluggish liver and kidneys, weak digestion, and “nerves.”

When 16 months old, he had a severe attack of “inflammatory diarrhœa.” This was treated with strong, astringent remedies; but the child’s life was despaired of, and further medical advice had to be procured before he recovered from the acute attack. Since then, the child had always been weakly and delicate; and had not made the progress which his parents anticipated from his robust appearance as an infant.

When about $2\frac{1}{2}$ years old, he had what was believed to be colic; and, later, was said to be seriously affected by malaria. In fact, he was always under the doctor’s care, and took tonics for years.

At the present time, he was described as nervous, irritable, and peevish; had great difficulty in going to sleep, often lying awake a quarter of an hour at night; and his sleep was disturbed and restless. His appetite was bad, and he disliked meat.

His muscles, particularly those of the head, arms, and shoulders, twitched violently, with a weird effect, which gave the impression that he intended to throw himself forward, especially on waking in the morning. He was undersized; and was backward in his schoolwork. His governess ascribed this to dulness; but his mother declared that he was, naturally, the sharpest of her children. He suffered from flatulence; and was costive at times.

This child had had an almost endless variety of prescriptions, of which only a few need be quoted here:

- R. Calomel gr. j
- Sodii Bicarb. gr. ij
- Ft. pulv. To be taken as directed.
- R. Santonin. gr. ij
- Ft. pulv. To be taken at bedtime.

[The date of this prescription shows that the child was then 2 years and 8 months old ; but he was given 2 grains of san-tonine, a dose that is known to have been fatal to a child of 5.]

℞. Pot. Iodid. gr. j
 Ammon. Carb. gr. j
 Sod. Salicyl. 3 j
 Tinct. Tolu 3 fs
 „ Senegae 3 fs
 „ Scillae ℥xx.
 „ Aconiti ℥v.
 Syr. Simp. ʒ ij
 M. ft. mist. $\frac{1}{6}$ part every 3 hours.

[Of this truly appalling mixture, the child, now $4\frac{1}{2}$, was to take $\frac{1}{6}$ part every three hours !]

EXAMINATION, Jan. 10th :—All the above statements were confirmed. The boy's growth was retarded, and he was very thin ; in fact, he did not look more than 5, and was distinctly anæmic. His manner was depressed and nervous. He could not read properly ; but this appeared to be due to a poor memory, and deficient power of concentration, as he was evidently a good and obedient child and very anxious to please. There was well-marked seborrhœa under the prepuce.

TREATMENT :—4 drops of the tincture 3 times a day. Constitutional treatment was commenced simultaneously.

PROGRESS :—On Jan. 22nd, twelve days later, the mother reported :—“ The first dose of your tincture checked those jerking movements. Each day it had a better effect, and I was surprised to note the number of threadworms he passed. The stomach, too, was regaining a healthier tone, as his motions were no longer dark-coloured and offensive. They were yellower and not so constipated. His appetite, too, was surprisingly good. . . . He sleeps more soundly, and many more hours than before.”

Case of a little Girl aged 6.

HISTORY :—A little girl, aged 6, was brought to me, apparently suffering from scrofula. She was pale, anæmic, and very depressed in manner, although, as I was informed, naturally a bright child. She had marked blue rings round the eyes,

and had suffered at times from a troublesome cough. Her appetite was fickle and capricious, and her sleep restless. A gland at the side of the neck was much enlarged, and had ulcerated; and a surgeon who had had charge of the case had operated upon it.

I ordered general constitutional remedies; and, a fortnight later, the mother informed me that the child had threadworms. She complained of great irritation, and was always scratching herself. As usual, in such cases, the mother anticipated that the worms would take a long time to expel.

TREATMENT :—The tincture was given as in case I., and constitutional treatment continued at the same time.

RESULT :—The irritation ceased after two or three doses, and the child slept much better. She passed a very large number of worms, all dead; but, after taking the tincture for three days, she passed no more. This was in October. About a month or six weeks later, it became clear that re-infection had taken place, as several more worms were passed. The medicine was, accordingly, given again for one day; after which, no more worms were seen.

At the end of four months, the gland in the neck had practically healed, and, in all probability, would leave no trace of a sinus; and the child looked so well that the surgeon, who had operated upon her before, was astonished at the alteration. In short, she appeared perfectly healthy in every way; and was developing into a strong child, from whom every indication of tuberculous disposition had been eradicated.

Case of the Sister of above, aged 11½.

HISTORY :—Shortly afterwards the mother of the above patient consulted me about her elder daughter, a child of 11½ years old, of a very reserved and shy disposition. The little girl was distinctly backward in growth. She did not sleep or eat well, was very pale and thin, and generally spiritless. No threadworms, as far as the mother and the nurse knew, had ever been passed.

TREATMENT :—I prescribed appropriate measures, and in accordance with a rule I have followed in such cases with much success, gave the child a few doses of my tincture for threadworms.

RESULT :—To the mother's great astonishment, hundreds of threadworms were passed in the excrements for a few days, then they ceased to appear, and the child almost immediately afterwards began to recover with encouraging rapidity.

Case of a Girl of 17.

HISTORY :—This was the case of a girl of 17 who had suffered from threadworms since childhood, and had been quite unable to get rid of them. She was a delicate and very anæmic girl, showing indications of a weak heart. The worms caused her to experience extremely severe irritation, which was always worse at night, when the nocturnal migrations commenced.

She had undergone treatment at the hands of several medical men, most of whom prescribed injections, either of warm water, soap and water, or salt and water. After an injection, she had to lie down for a quarter of an hour, and they gave her so much pain as to make her cry. This was most marked when soap was used. Finally she decided that she would rather endure the annoyance of the worms than the pain due to the injections, especially as the latter only gave her temporary relief for a day or two, unless repeated for weeks on end.

TREATMENT :—The tincture was given, as in the other cases, but no constitutional treatment was undertaken, at the request of the patient.

RESULT :—All irritation ceased, to the patient's great surprise, on the first day ; and within three days, all the worms appeared to be gone.

NOTE.—Owing to a variety of circumstances, this patient did not undergo a course of general constitutional treatment, and so did not acquire that immunity from the attacks of threadworms, which, as a rule, is not very difficult to attain and which generally carries with it increased vitality in other respects. Accordingly, she showed signs of fresh infection from time to time ; and this occurred almost invariably if she partook of green vegetables. But, the remedy being at hand, it was at once applied, and a single dose nearly always sufficed to remove all the worms. In these cases of fresh infection,

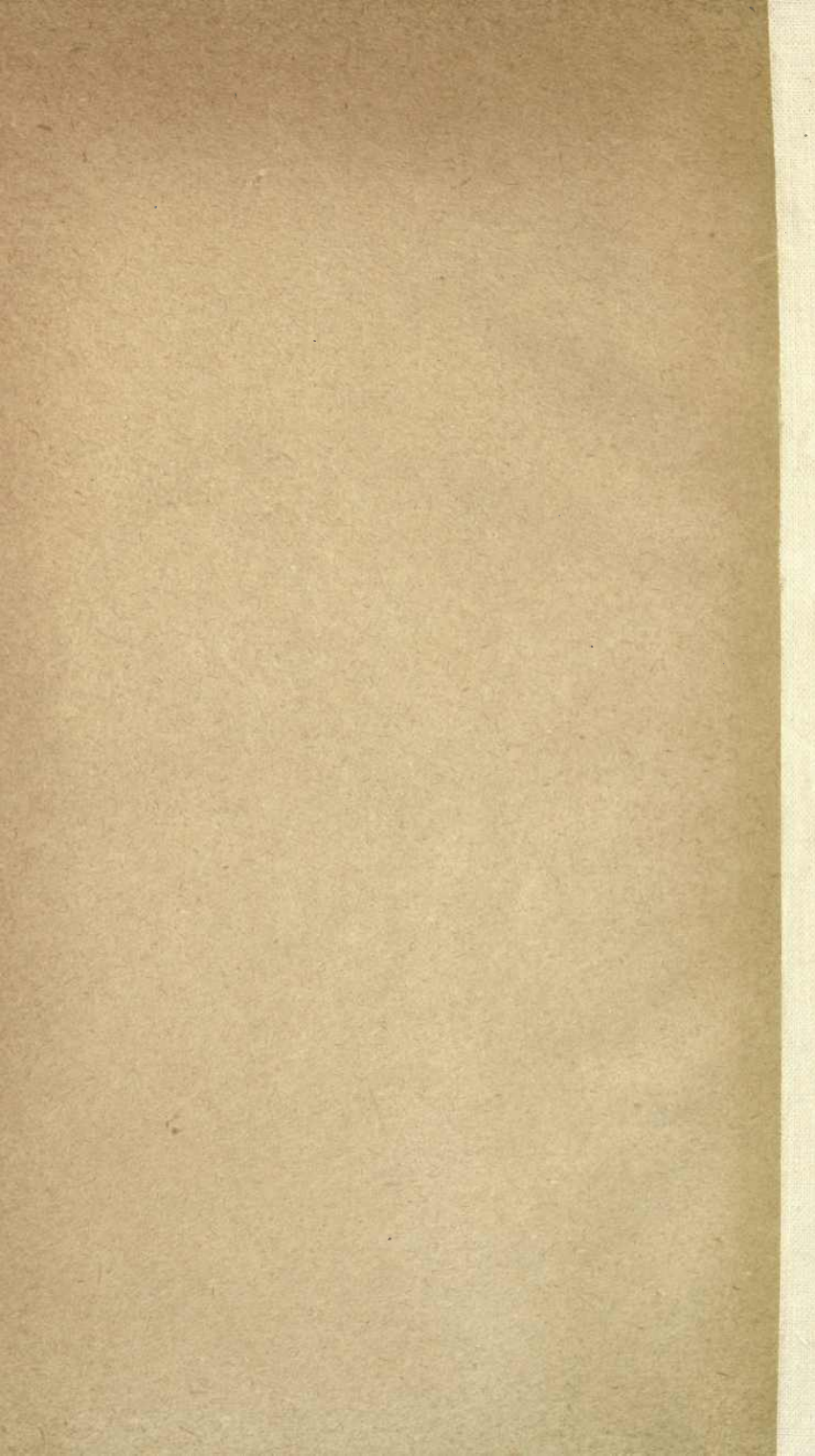
the drug is generally given immediately the signs are observed, before the parasite has time to become firmly established ; and this appears to be the reason that the effect of the medicine is always even more rapid than in the first instance.

Concluding Remarks.

The above are only a few examples from the very large number of cases of threadworm disease which have come under my care, and in which a uniformly successful result has been attained by means of the tincture. I have carefully avoided mentioning any case which was complicated by other definite disease, because to do so would only have led to confusion in describing the treatment. I have confined myself to instances in which only such complications were present as are common to nearly every case.

Broadly speaking, the sufferers fall into two groups. There are those who are aware that they have threadworms, and those in whom the trouble is not suspected. The latter is the commoner occurrence, and is mostly the case with children, diagnosis being frequently difficult. Consequently, when consulted about ailing children, whatever their symptoms, I make it an invariable rule to prescribe a few doses of the tincture in addition to the other appropriate measures. I do so with the knowledge that the minute quantity of the remedy given cannot possibly result in any harm ; and my doing so has been amply justified in the numberless cases where it has led to the discovery of threadworms, not previously suspected. My assumption that the parasite has been responsible for some, if not all, of the troublesome symptoms has found indisputable confirmation in the fact that the latter disappeared as soon as the parasites had been got rid of.

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